NATURE

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Vol. 143 SATURDAY, MAY 6, 1939 No. 3627

Industrial Development and Social Welfare

FEW major questions have emerged so rapidly from the theoretical to the practical stage in recent years as that of the location of industry. When the problems of the location of industry in Great Britain were first discussed by Political and Economic Planning (P E P) in 1931, the idea of guiding the location of industry was generally dismissed as impracticable, and little improvement in public opinion was discernible when P E P in 1935 first began the preparation of its report on this question, a summary of which appears elsewhere in this issue (p. 770). Since then, however, many authorities and considerations have stressed the importance and urgency of attention to the complex problems which this question presents.

This was one of the main points made by Lord Stamp in urging the establishment of a Royal Commission upon population changes and the agencies required to deal with questions arising from these problems as they develop. A programme of research proposed by a group of experts in the universities, quoted by Lord Stamp in his "The Science of Social Adjustment", includes a quantitative investigation of regional distribution of population with reference, among other matters, to the location of industry. The report of the Town Planning Institute last year, recommending a National Advisory Board, directed attention to the importance of recognizing trends in population changes due to the location of industry as well as to changes in age distribution and the declining birth-rate.

Already in 1934, in endowing the Commissioners for the Special Areas with financial and other powers to induce industries to locate themselves in areas of unemployment, Parliament has given a limited shape to the public concern that industrial enterprise should be so prompted and directed that it would meet effectually the requirements of the community, not only in the supply of goods and services at the point where they are wanted, but also in the supply of employment where it is wanted. The reality of that public concern finds further expression in the view asserted in Parliament and elsewhere that the Special Areas Act itself is an experiment to determine the value to these areas of providing special treatment, and to learn whether the results obtained warrant a wider application. The pressure of opinion which compelled the Government early in 1937 to over-rule a departmental decision to build an aircraft factory in the Maidenhead district sprang as much from growing awareness of the necessity of long-range statesmanship and resolute scientific investigation in the interlocked problems of town planning, location of industry, national health and defence and the provision of amenities, as from the threat to amenities and the vulnerability of a factory contiguous with the Greater London area.

The dangers of the excessive concentration in the Greater London area were emphasized in many ways at the time of the September crisis last year, and planned control of the growth of London has been advocated by Sir Raymond Unwin before the Garden Cities and Town Planning Associations. Since then, the question of planning the location of industry in regard to defence has assumed increasing importance as a factor in defence against air attack, and defence considerations have to be taken into account in any system of State guidance or location of industry.

The P E P report leaves no room for doubt as to the complexity of the problem and its dynamic rather than static character. Essentially the location of industry involves the problem of the

use of the land. This is the affair of town and country planning and of land management. With this particular aspect, local authority planning committees, the Ministry of Health, individual landowners and agents in charge of public or semi-public estates are already dealing. The chief need here is to secure a better informed and more co-ordinated type of development, through a central planning body able to collect the necessary information and use it in guiding the local authorities concerned. Some pooling of ownership and management, in the public interest, of land in and around growing towns may also be required.

Secondly, there is involved the maintenance of a balance between different regions of Great Britain which will prevent some from exploiting and sapping the vitality of others, and in particular prevent London from dominating further and enfeebling the life of the rest of the country. The third problem is regional development and the guidance of the location of industry. This problem affects the industrialist, the utility services, the Board of Trade and the Ministries of Labour and Transport, just as the second concerns public administration, aided by the universities, the British Broadcasting Corporation and other cultural agencies.

The report frankly recognizes that a long-term policy is involved, and that many years may pass before the full effect of that policy is felt, even if a number of immediate steps could be taken to improve the present situation or minimize its dangers. The first need is, however, the elaboration of a definite and constructive national policy, and in this a clear statement of objectives is required. The State, it is true, cannot be expected to avert the consequences to industries of natural phenomena, technical progress or international forces. At the best it can only mitigate them. When, however, the odds are lengthening against the selection, by the most far-sighted industrialist, of a location which will remain economic for him for a long period, owing to the increasing rate of technological change and the multiplication of extraneous and unpredictable factors, it is essential that the State be prepared to establish services which will enable the industrialist to perform his function more efficiently.

To promote the efficient functioning of industry without detriment to existing standards of living or disruption of society is one of the first objects of national industrial policy. A second objective must be the co-ordination of the many State activities which affect industry and economics, so as to eliminate overlapping and waste and to co-ordinate the provision of State services generally with industrial requirements over a long period. Powers will also be required to curb the activities of the minority of economic pirates whose influence may be out of proportion to their numbers, and it is now necessary for the State to possess powers to direct the nature of industrial development with reference to the requirements of national security.

The primary need, accordingly, is a well-formulated but flexible policy which will guide the use of all national resources. In several spheres a start has already been made in this direction: the unification of coal royalties in the hands of the Coal Commission, the establishment of the Electricity Commission and of the Central Electricity Board, as well as the unification of numerous local bodies into catchment boards, being examples. As yet, however, the control of the use of the land under the Town and Country Planning Act, which must form the starting-point of any form of actual control over national resources, is scarcely effective, and it is evident that local authorities should be given more explicit guidance in the principles they should observe.

Industrial location is, of course, a wider problem, involving a balance between the varied economic requirements of the community and the requirements of the manufacturer, and a fundamental conclusion of the report is that it requires treatment as a whole on a national as well as on a regional or local scale. Reconditioning of the present Special Areas and the prevention of the recurrence of the same troubles elsewhere can only be a gradual process. Permanent machinery is required for guiding and adjusting industrial growth.

Extension of national action in this respect would require a reassessment of priorities, and this in turn involves the collection of information and the evolution of a satisfactory method of measurement. Existing methods of measurement have scarcely been adequate for the complex problems of measuring the current prosperity and future prospects of localities, and accordingly one of the major tasks of the Industrial Development Commission proposed in the report would be the provision of a centralized information service to assist industrialists in the choice of sites and locations of new plant and in problems of industrial development generally.

This proposed Commission would accordingly be charged with the responsibility of keeping under

review factors affecting the efficient operation of industry, with particular reference to those factors arising from the choice of location. It should be empowered to publish information concerning the facilities available for the establishment of factories in all suitable areas. It should be provided that the services of the officers of the Commission would be available for prior consultation by persons desiring to apply for licences in respect of new factories or extensions.

This is regarded as one of the most important sections of the work of the proposed Commission, and the smooth working of the machinery as a whole would probably depend largely upon the success achieved by the Commission in collecting and disseminating information and advice calculated to assist manufacturers in this matter. An efficient central advisory service, in practice, might obviate all question of compulsion in the majority of individual cases, since the choice of a suitable site would be determined in amicable agreement, and confirmation of that choice through the licensing machinery would then be a formality. Moreover, such a service, on the basis of continued research, should relieve industrialists of the laborious and wasteful task of conducting their own preliminary investigations, and present the relevant facts for consideration much more rapidly and lucidly. It might also put before the industrialist factors he might otherwise overlook, such as the interest of the industrialist as well as of the community in creating and maintaining a reasonable balance of industries within broad economic regions.

The organization of an efficient information service is largely a matter of intensive economic research into the growth of industry and the factors affecting it, and of ensuring that the service is recognized by industry and used in practice as a matter of course. The task of undertaking the necessary research and keeping the information up to date should not, however, be under-estimated. It involves, for example, the determination of the economic regions into which Great Britain would be divided by the Commission, and the needs of those regions in relation to industrial balance. A comprehensive knowledge of sites available and suitable for further industrial development is essential as well as a full knowledge of the existing distribution of industry and of national resources generally. It also involves the determination of a line of policy with regard to social and strategic considerations in relation to the distribution of unemployment, vulnerability to attack and other factors.

We have here, in fact, a scientific approach and a programme of research which have long been advocated by those, within the ranks of scientific workers or without, who have sought to approach these complex problems in the spirit of science. This alone should commend the report and its recommendations to the interest and support of scientific workers, while the value and magnitude of this preparatory work are indicated in the opinion expressed in the report that a considerable interval would be justified between the establishment of the Commission and the coming into force of certain of its executive powers, such as the licensing provisions.

The second main purpose of the Industrial Development Commission recommended by the report is the co-ordination of policies and actions of central and local government authorities, public utilities and other institutions, and it is in pursuance of the task of guiding the future location of industry, to avoid the repetition and multiplication of mistakes of the past, that the report suggests that the Commission should be charged with the responsibility of licensing new factories or extensions to existing factories. Such powers of restraint are regarded as essential, although it is believed that only rarely would it be necessary for the Commission to exercise its veto. Not the least service of the report is the way in which, fairly but undisguisedly, it puts the case for such compulsion.

These proposals of the report in regard to the licensing of new factories and evacuation and resettlement schemes for derelict areas, radical as they seem, are only the logical extension of principles which have already been tentatively adopted. Moreover, the clear but far-sighted statement of the principles of evacuation or re-settlement which the report contains should dissipate controversy on general ideas and facilitate the elaboration and execution of detailed plans, even if the financial estimates of the report prove to be somewhat optimistic. The conception of spending to create a model town, instead of prolonging the life of one that is moribund, is essentially in keeping with a scientific policy, and the bold constructive proposals of this report have strong claims on the attention of all scientific workers who are in sympathy with its underlying conception of a new co-operation both in form and in purpose for the integration of industrial expansion and social welfare and stability.

Science and Trusteeship in Africa

Science in Africa

A Review of Scientific Research relating to Tropical and Southern Africa. By Dr. E. B. Worthington. (Issued by the Committee of the African Research Survey under the auspices of the Royal Institute of International Affairs.) Pp. xiv+746. (London, New York and Toronto: Oxford University Press, 1938.) 10*s.* 6*d.* net.

IN his Rhodes Memorial lecture in 1929, General Smuts directed attention to the paucity of information available regarding the policies, activities and plans of the different European colonial powers in Africa, and made the valuable suggestion that a comprehensive survey should be undertaken to collect such material. A committee was appointed to give practical effect to his proposal; funds were made available by the Carnegie Corporation of New York; Sir Malcolm (now Lord) Hailey was invited to direct the survey, and a number of preparatory studies of different aspects of the survey were commissioned. Among other studies, Dr. E. B. Worthington, whose biological studies of East African lakes are well known, was asked to prepare a report on the progress of scientific research and technical services having a bearing on African development. Dr. Worthington began this work in the autumn of 1933, and in the course of his studies accompanied Lord Hailey during 1935 and 1936 in his visits to Nigeria, Dahomey, Togoland, the Gold Coast, Sierra Leone, Gambia, Senegal and the French Sudan.

When Dr. Worthington's draft report was completed, the committee in charge of the Survey came to the conclusion that the material it contained should be published as a separate volume: for while much of it could be summarized and incorporated in Lord Hailey's comprehensive survey, to do full justice to Dr. Worthington's studies and to provide scientific workers and scientific and technical institutions, both in Africa and Europe, as well as the many interests associated with African finance and administration, with a detailed record of scientific endeavour and its bearing upon African development, demanded space which would have added too greatly to the bulk of the major volume and upset its balance. The committee is to be congratulated on its decision and Dr. Worthington on the result of his labours. With the assistance of specialists in many fields of research, he has presented us with a clear account of the nature and extent of the problems confronting African administrations, the contributions which scientific workers have already made towards their solutions, an indication of the paths in which their future activities should be directed and the organization necessary in order that the results of research may be more effectively applied.

From one point of view this is an encouraging volume: from another, exasperating. It is encouraging because much has been done during the past fourteen years to improve and extend the scientific and technical services in British Colonial Africa, where any existed, and to provide them where there were none. At least some of the prejudice against central research stations has broken down with recognition of their obvious utility. Also there is a growing tendency to utilize the services provided by the Imperial Research Bureaux. Other European Colonial powers are paying much more attention to the function of utilitarian scientific research in the development of Africa's resources. The Belgians—to a lesser extent the French—have developed a system of co-ordination between scientific workers in Africa and those in the universities and research institutions in Europe which presents features that might with advantage be incorporated in our own. Another important point is the realization by the several European Colonial powers that certain problems are common to all African territories, for the solution of which international co-operation and pooling of funds and effort is essential. Some of this co-operation is effected through the Health Section of the League of Nations, some by the interchange of information and literature between the different centres in Europe, and at least one major menace, the locust, has led to the formation of an International Locust Control Committee.

It is expecting too much, however, for international co-operation to advance rapidly while the co-ordination of research and technical services of British territories is still meeting with opposition. Many local executive and legislative councils still lack the vision to realize that well-staffed and well-equipped laboratories serving groups of territories and drawing financial support from each member territory of the group would result in economies as well as more effective work, at the same time giving urgently needed assistance to those territories which at present lack the money to provide any research services of their own. Again, even in some British territories there is

much avoidable waste of effort due to the non-existence of any machinery for the systematic collection and dissemination of data from the notebooks of field-workers: neither is there any effective agency for the interchange of results and information between the different scientific and technical departments. Further, there is still far too little co-operation between the universities of the British Empire and other centres of research, and those agencies directly responsible for the investigation of African problems.

There is yet another aspect of co-operation to which Dr. Worthington directs attention. It must be obvious that the fight against human, animal and plant diseases, the war against pests like the mosquito, tsetse-fly and locust, effective measures against erosion, soil desiccation and the destruction of forests, and the general improvement in methods of cultivation, stock-raising and the health of the people, depend upon the effective co-operation of Africans with the European personnel. In their present stage of development, the tropical and sub-tropical African territories cannot be expected to shoulder much more in the shape of additional financial burdens involved in the essential expansion of the specialist services, unless the expansion either takes the form of the employment of African personnel or the European powers are prepared to advance the necessary funds for considerably more European specialists. But even if money is forthcoming from outside Africa, it would better be spent on the training and recruitment of Africans than on the provision of many more Europeans. Already the time of many highly trained Europeans is too much occupied in performing routine field duties which experience has shown could be quite efficiently done by Africans were they given the necessary preliminary education and training. This much is certain—not until there are thousands of trained Africans co-operating with Europeans will the results of the researches of the latter into African problems bear the fruit they deserve. Africa has an abundance of generals, but it lacks the disciplined forces to fight this epic battle with Nature. Mass education for Africans alone can provide the material from which these forces can be raised.

It is impossible to give, even in outline, an account of the work on African problems which Dr. Worthington surveys in seventeen chapters on the different specialist services, or even to summarize the gaps and deficiencies which must be made good. It must suffice to commend the volume to the attention of all scientific workers interested in tropical and sub-tropical research: to all individuals and companies interested in the economic development of the territories: to all missionaries and education officers: and to all members of African administrative services. It will be of the greatest service to them. Together with Lord Hailey's survey and Prof. Frankel's masterly account of "Capital Investment in Africa", it should help them to appreciate the magnitude and complexities of the tasks before them and, above all, the implications of European trusteeship.

A. G. CHURCH.

Precautions against Air Raids

Commonsense and A.R.P.
A Practical Guide for Householders and Business Managers. By Major-General C. H. Foulkes. Pp. 92. (London: C. Arthur Pearson, Ltd., 1939.) 1s. net.

THERE has been so much nonsense talked and written about A.R.P. that it is refreshing to read this little book, even if one does not entirely agree with all it contains. It will not be popular to suggest that the reason for the better balance with which the subject is here presented is that the book is written by a soldier; but much misunderstanding would be avoided if the public could be made to realize that A.R.P. is a war problem. It is true that General Foulkes is an exceptional soldier, because besides being an engineer officer of great experience he was Director of Gas Services during the war of 1914–18; so that anything he has to say, either on the subject of cover from high explosive or on defence against gas, is worthy of the closest attention. He has also been consulted by many important works and offices about their A.R.P. schemes, so that he has a wide knowledge of the problems that actually arise. The book lives up to its title, and is a simple and practical guide to those who wish to take reasonable precautions.

I must join issue with General Foulkes on one point. On p. 27 he says:

"Expert opinion is now almost unanimous in believing that gas is very unlikely to be used, not because of its supposed inhumanity, but because it would not be as effective, weight for weight, as high explosives when employed against an organised community sheltered in buildings. The

conditions were very different in the chaotic state of the battlefield: men had necessarily to occupy gas-contaminated ground for days at a time; and guns had to be served and ration and working parties were compelled to expose themselves in the open. Decontamination of scores of square miles of scarred surface was an obvious impossibility, and the air in a bombarded area remained dangerous for days, while contaminated mud was often carried unwittingly into sleeping quarters, with disastrous results."

Now consider an area containing important munition works surrounded, as many are, by workers' dwellings; after a bombardment with high explosive many of the houses would be blown down, and the area covered with dust and debris. If such an area were bombarded with mustard gas it would be extremely difficult to decontaminate—in fact, the present method of decontamination would not succeed in removing mustard gas from a pile of broken brick and plaster—so that, to quote General Foulkes, the air in the bombarded area would remain dangerous for days. The workers would therefore either have to evacuate the area, remain in their houses, or stay in the factories. Unless they stayed in the factories, work would be stopped, and even if they did stay, transport to and from the factories would have to pass through the area to bring food and materials and to remove manufactured articles. In any event, I think that there would be a large number of slight casualties from carelessness, and a hundred thousand sick, on account of the care they would require, may be a great disadvantage in war.

I do not wish to exaggerate the power of gas, but it is dangerous to belittle it, and we should not forget that during the Great War mustard gas was distributed in shells and only came in pints, whereas in aeroplane bombs it would come in gallons.

The book makes no mention of the magnesium incendiary bomb, which in my opinion is likely to prove more effective than the thermit bomb. I am also sorry to find that there is no reference to the possible use of bacteria. But perhaps these matters are left out for the sake of simplicity, which is the keynote of the whole book.

The author has a keen sense of humour but he has carefully suppressed it, so that it only breaks out, generally in the form of a footnote, when some irresistible absurdity has to be exposed. The book is cheap, clear, and concise, and should be read by everyone in a position of responsibility. Its value is largely due to the acceptance of three fundamental facts, namely: (1) that if we fight at all the paramount policy is to win the war; (2) that our resources, though large, are not unlimited, and must be disposed of in accordance with this policy; and (3) that in war time some casualties are inevitable.

H. A. SISSON.

To-day and To-morrow in Inorganic Chemistry

Modern Aspects of Inorganic Chemistry

By Dr. H. J. Emeléus and Dr. J. S. Anderson. (Twentieth-Century Chemistry.) Pp. xi+536. (London: George Routledge and Sons, Ltd., 1938.) 25*s*. net.

THE science of inorganic chemistry to-day is very different from what it was fifty years ago; it has been invaded, even pervaded, by physics to an extent that it is the physical and physico-chemical aspects which are taught to-day and are destined to provide the developments of to-morrow.

The modern student of honours standard has no difficulty in approaching the subject from this angle; the older generation find it less easy, especially as the rate of progress is so fast that what is regarded as fact to-day may be cast aside to-morrow. Perhaps only believers should study modern physics; critics as a class may have to wait a decade before they are tolerated as of service.

The personal reputation of the authors of the work under notice ensures their competency to undertake the task, which they avow in the preface, of reviewing the developments of the last two decades and relating them to the science as a whole: the book is intended for teachers, honours students and research workers, and has the further laudable object of helping to overcome the comparative neglect of inorganic chemistry in Great Britain as compared with its popularity in Germany. The authors believe that it should rank as an absorbing experimental science which offers unlimited opportunities for the development of new experimental methods.

The reviewer endorses this view the more because he clearly remembers practically the same thing being said by the greatest of organic

chemists, Emil Fischer, about 1900 to his two young assistants, O. Ruff and A. Stock, when first causing them to work on the subject of inorganic chemistry. The literature shows how much these two men and their students have since contributed to the subject, and one can admire the prescience of Fischer at a time when organic chemistry was so vigorous. It is to be hoped both that the British authors will imitate the men mentioned and that their book will inspire others to do likewise.

The time-worn method of discussing the elements by groups has been abandoned. First comes atomic, then molecular structure, followed by chapters on co-ordination compounds and inorganic stereochemistry, which leads up to polyacids and silicates. Hydrogen and the hydrides receive a chapter, as do the peroxides and peracids, the carbonyls, etc. Another section deals with reactions in liquid ammonia and liquid sulphur dioxide, and a final one with radioactivity and atomic disintegration.

At bottom the book is essentially chemical, and though stiff reading to many of us, it is as clearly written as is possible in these days when scientific language contains so many coined words that it requires the aid of a glossary to interpret it.

E. F. A.

Rock Carvings in the Far North

Monumental Art of Northern Europe from the Stone Age

By Gustaf Hallström. 1: The Norwegian Localities. Pp. 544 + 64 + 48 plates. (Stockholm: Bokforlags Aktiebologet Thule, 1938.) n.p.

THE occurrence of rock carvings in Norway and Sweden has long been known. They are found on hard rock surfaces on the west coasts of Scandinavia from the county of Tromsö right up in the north to the extreme south of Sweden. They also occur inland in Jemtland and elsewhere. More than one technique can be observed and palimpsests also have been found. Clearly this art includes figures of very different ages. Actually two distinct groups can be distinguished. One is centred in Bohuslän, north of Göteborg, and is well known, being characterized by the large number of ships depicted; it dates for the main part to the Bronze Age and has been well studied and published; figures belonging to it are found so far north as the Trondhjem district.

The second group, with which the present work is concerned, is the older. This can be demonstrated at Bardal where a superposition occurs, figures belonging to the Bronze Age group being uppermost. For the most part these older rock carvings are of animals executed in a naturalistic or semi-naturalistic way, but signs and other figures do also occur. Very occasionally paintings both of human beings and of animals are found, but these are invariably extremely conventionalized. This earlier art group can be subdivided, a three-fold chronological sub-division having been determined by considering (*a*) palimpsests, (*b*) style, (*c*) position. As many of the decorated rocks occur on raised beaches which were once under the sea, it is sometimes possible to be certain of a date *post quem*, at any rate. This art is usually connected with the Arctic Culture, the roots of which lie far back in mesolithic times. The motives underlying its production are completely unknown.

The present work is in the nature of a catalogue of this early art group in Norway. The second volume, dealing with the sites in Sweden, Finland and Russia, will be published in about a year's time. Actually, of course, the title is misleading. These glacier-worn surfaces of rock covered with engravings or pockings should not be described as monuments, but this does not detract from the very great importance of the work as a whole, and archæologists will be particularly grateful to Dr. G. Hallström for having at last put on record a corpus of the finds. The system he has adopted is geographical, and a numbered sketch map gives the position of the various sites, which are then described in order. There is a number of illustrations at the end of the volume and a separate portfolio of reproductions of the drawings.

In no sense is the work meant for armchair reading. It is a catalogue, but none the less important for that. The English, though sometimes a trifle quaint, is not obscure. May I recommend that anyone wishing to spend an interesting vacation abroad should acquire this book and visit some of the sites therein described. Doubtless the explorer will find it wise to bind up the work in three or four smaller fascicules for convenience of handling, but I know I can promise him a very interesting expedition, made possible for the first time by the publication of this work. We all eagerly await the second volume.

M. C. BURKITT.

The Ojibwa Woman

By Ruth Landes. Pp. viii+247. (New York: Columbia University Press; London: Oxford University Press, 1938.) 15*s*. net.

THE psychological study, of which Miss Landes gives the results in "The Ojibwa Woman", was undertaken with the express purpose of pursuing the inquiry in conditions other than those, that is, of Western civilization, in which similar psychological investigations have usually been carried out. Her choice of the Ojibwa of western Ontario, among whom she spent seven months collecting material, was well judged. The conditions, which here form the background, were certainly both unusual and peculiar. In the Ojibwa society, which came under Miss Landes's observation, it is only the male half of the population and its activities which fall under traditional regulation. The female half is left to a spontaneous and confused behaviour. In consequence there is a wide range of development in the personalities and careers of the women. As the author says, "Some rival the most successful men in ambitions and honours received, but do not pursue them in systematic male fashion; others engage in both male and female pursuits; still others are reduced to an incompetence that continues until death". This dictum is demonstrated in detail, and the resulting conduct and mentality of men and women are contrasted in youth, in marriage, in occupations and in abnormal manifestation. The force of the study is much enhanced by a free use of the actual words of the subjects under observation, and further illuminated by a number of life-histories.

Étude pratique des rayonnements

Solaire, atmosphérique et terrestre (méthodes et résultats). Par Ch. Maurain. Pp. iv+189. (Paris: Gauthier-Villars, 1937.) 80 francs.

IN this monograph, Dr. Ch. Maurain, the director of l'Institut de Physique du Globe, covers chiefly from an observational point of view the important study of radiation, solar, atmospheric and terrestrial. Certain phenomena associated with the ionosphere indicate that the sun's ultra-violet radiation varies in sympathy with the eleven-year sunspot cycle; yet the reality of a related periodic variation of the integrated radiation (the 'solar constant') as received at the earth's surface is extremely difficult to demonstrate in spite of years of observation linked with the name of C. G. Abbot (see NATURE of April 29, p. 705). Passing from the determination of the solar constant, there is the allied study of the incoming solar radiation as it passes earthwards through the atmosphere: the long-wave radiation from atmosphere and earth, and the distribution of these various factors in the energy balance sheet, which Dines first showed meteorologists how to prepare.

The present work usefully brings together the methods of measuring the various quantities involved, the instruments used, their principles and the practical difficulties encountered. A number of numerical examples and other tabular matter include observations made at the Observatory of Saint-Maur near Paris.

La Vie morale et l'au delà

Par Jacques Chevalier. (Bibliothèque de Philosophie scientifique.) Pp. 211. (Paris: Ernest Flammarion, 1938.) 17 francs.

THIS timely work gives an analysis of the ultimate causes of the darkened intellectual outlook of our time, and proposes the necessary remedies. The excess of liberty and the restriction of liberty which characterize our age are to be accounted for by the absence of strict moral discipline. But an ethical doctrine is not to be constituted at random to suit some particular ends: it must be founded upon a rigorous metaphysics embodying a clear vision of reality and the spiritual values attached to it. This reality does not stop short at the world of appearance; but it goes beyond it and causes our belief in another life the nature of which is the real foundation of our moral discipline in this world.

Written in beautiful language and displaying with restraint a valuable metaphysical experience, this recent work of the learned dean of the Faculty of Letters of the University of Grenoble is well worthy of an English translation. T. G.

An Introduction to Chemistry

By Prof. John Arrend Timm. (International Chemical Series.) Third edition. Pp. xx+568. (New York and London: McGraw-Hill Book Co., Inc., 1938.) 21*s*.

IT is not surprising that Prof. Timm's book has reached a third edition since its first publication in 1930, for it has many features which will recommend it to students and teachers. It is not so much a regular text-book of physical or inorganic chemistry as a general survey of many parts of chemistry which are of particular interest. It does not deal systematically with the elements, and in fact it requires much supplementing by other books; but it takes up such topics as the atomic and molecular theories, atomic structure, valency, combustion, radioactivity, solutions and electrochemistry, colloids, and some parts of organic chemistry, and develops these subjects in a very interesting manner. There are many historical allusions.

Les Méthodes actuelles de la chimie

Par Prof. Pierre Jolibois. (Collection Armand Colin: Section de Chimie, No. 37.) Troisième édition entièrement refondue. Pp. 224. (Paris: Armand Colin, 1938.) 15 francs.

THIS unpretentious little book gives a very accurate and readable survey of the fundamentals of physical chemistry and their applications which all students could digest with profit. The mathematical equations are not deduced; but they are clearly stated and their applications are illustrated by well-chosen examples. Recent advances, such as Raman spectra, strong electrolytes and the structure of crystals, are included, and the sections on the phase rule are particularly good. Students who wish to improve their knowledge of scientific French and at the same time to clarify their ideas on many branches of physical chemistry will find this an excellent book for their needs.

The National Nutrition Conference

THE modern State accepts without serious question the duty of applying, without stint, all the resources of science and finance to the effective defence of its citizens from enemy attack. It would appear at least equally important that the democratic State should utilize all the help of modern science to make its citizens worth protecting.

The cost in money of providing proper and adequate food for every citizen in Great Britain who at present is unable to provide it for himself is at the worst only a fraction of the cost of defensive armaments, whilst the cost in disease, in social and industrial or even military inefficiency and in sheer human distress of allowing malnourishment to continue is one that no civilized people can afford.

An adequate scientific basis has existed for several years for a positive national nutrition policy linking health and agriculture; there has been wide discussion of the bases of such a policy, and an increasing demand from several quarters that it be put into practice. This policy would on one hand provide the benefits of a sufficient supply of total nutrients, and in particular of protective foods—milk and dairy produce, fresh fruit and vegetables, eggs, fish, and, to a lesser extent, fresh meat, most of which are produced at home or in the Dominions—to citizens of all ages; and on the other hand it would assist the home farmer by giving him a much larger and guaranteed market for that type of human food which the climate and soil of Great Britain are particularly suited to provide.

All interested in the development of a healthy, physically fit citizen must therefore have welcomed the decision of the British Medical Association to call a national conference to deal with the wider aspects of nutrition.

The conference was duly held during April 27–29 at British Medical Association House. In view of quality of the discussions and the character of the participants—there were many senior representatives of medicine, physiology and nutritional science, agriculture at home and abroad, industry, social services, and education present—its pronouncements can only be ignored by a Whitehall completely insensitive to informed public opinion. With our present Government, these discussions can scarcely fail to encourage those who frame our policy to act, and to act quickly. The gap between the extent of our nutritional knowledge and the social utilization of such knowledge on a national scale has been widening steadily, and further delay can only mean, in terms of readily understood coinage, inferior recruits, persistent industrial inefficiency, continued high expenditure on hospitals and sanatoria, and more subsidies of the wrong kind to farmers, and, in terms of a different coinage, an unconscionable waste of human life, happiness and potentialities.

The conference covered a wide field. The inaugural address was delivered by Sir Arthur Salter, M.P., who summarized the general findings of recent nutritional surveys in Great Britain and recalled the inevitable conclusions drawn as to the inverse relationship, on the whole, between income on one hand, and disease and death-rates on the other. He pointed out the great part played by milk in the prevention of malnutrition, the severe economic penalty now attached to large, or even moderate families, and the necessity that the cost of the major items in the cost of living figure should be kept to an absolute minimum. One of the policies he advised is a standard guaranteed price to home producers of the more important foodstuffs. He criticized severely some of the recent measures adopted by the State to help farmers as ill-conceived and wasteful, and in particular the weaknesses inherent in the Agricultural Marketing Acts. By this legislation, for example, the consumer price of milk is controlled by the statutory power of the Milk Marketing Board, a body composed solely of producers, which must inevitably consider milk primarily as the channel of an important part of the farmer's income, and only secondarily as the most essential of foods. The whole system of control should be reformed so as to make the public interest prevail.

Sir Arthur gave an account of the present position of Great Britain as regards food storage requirements, and urged the need for provision of food reserves on a much more adequate scale than anything that has yet been done. One per cent of our annual defence expenditure would provide the total sum required to handle the necessary quantities.

Following the inaugural address came a discussion on the physiological aspects (miscalled in the programme the 'medical' aspects) of nutrition. Prof. E. P. Cathcart pointed out that proper nutrition depends not only on an adequate and balanced food intake, but also on exercise, sleep, housing and working conditions, and adequate relaxation of body and mind. He made a cautious

survey of some of the requirements of an adequate diet, emphasized the need for education on how best to spend a relatively low income and how to make the best use of available foodstuffs. Dietary habits, despite man's natural conservatism as regards food, are changing for the better. It is most desirable to study the means by which this slow change in dietary habits could be accelerated. Dr. G. P. Crowden mentioned, *inter alia*, one of the ways in which this is being done, namely, by wide circulation of small, inexpensive household guides on sound dietetic lines, containing shopping lists, menus and recipes.

Major-General Sir Robert McCarrison, in a cogent contribution, emphasized that there is now no controversy about the main principles of nutrition. Food, as fresh and natural as possible, produced from unimpoverished soil, is the main factor for health. He regards malnutrition as essentially a functional disturbance, and only in its later stages does malnutrition lead to gross bodily changes. His plea for more precise methods of assessing malnutrition, especially in the young, was repeated time and again throughout the conference. Another factor requiring further research and elucidation is 'freshness' in food. What exactly does freshness mean, and how important is it, nutritionally? This was mentioned by several speakers. Later speakers also stressed the real need for keeping clearly distinct the *minimal* diet, on which health might be barely maintained, and the *optimal* diet which, without excess, provides a factor of safety.

The second session, on the "Means of Stimulating Production (*a*) Home Agriculture" was under the chairmanship of Sir John Russell. The thesis of Lord Astor's paper, which immediately followed the chairman's pertinent remarks as to possible ways of reorganizing agriculture, was that the abolition of malnutrition should be the next major social reform. He, in common with other speakers, expressed deep dissatisfaction with recent agricultural-cum-nutritional policy. It is high time that a home agriculture should be developed which is more suited to our times and needs—among which adequate nutrition of the whole population is the foremost—and which avails itself more freely of recent scientific and mechanical progress. Although home agriculture is still very much alive, the gross output of British farming being greater than it has ever been, he considers that, with the further spread of progressive methods of production, the protective foods could be provided for all consumers at cheaper rates than those now in force. Properly planned distribution, from which redundant services have been eliminated, can still further cheapen the consumer cost of milk, for example. These benefits should not be withheld any longer by marketing boards, whose present freedom from Parliamentary control should be withdrawn. He enlarged on the changes which might easily be brought about in milk production and would benefit producers and consumers alike, and regretted the hasty withdrawal last December of the Milk Industry Bill before it received proper consideration by Parliament. Public money is being spent on agriculture now in a wasteful way which helps only a few farmers. This money should be available to finance a properly conceived, national nutritional-cum-agricultural policy, which would bring health and welfare to millions, not least to the farmers themselves. Dr. Keith Murray, in a thoughtful paper, also gave reasons for believing that some form of subsidy from the Exchequer would be required, at least until such time as increased productive efficiency, a factor normally of slow operation, should have caught up.

Mr. Anthony Hurd agreed that farmers could make a much bigger contribution than they are making at present towards the better feeding of the human community, and also stressed the need for wider education in food values. Both he and Mr. Cleveland Fyfe regard it as essential to consider also the balance of farming and the need for the preservation of the fertility of the soil so that the generations of farmers who come after can continue to play their part without hindrance in the future feeding of the nation. Prof. W. C. Miller emphasized that the health and adequate nutrition of farm stock are prerequisites to the production of satisfactory dairy produce, poultry and eggs, and that any increasing demand for home-produced protective foods could not be met without a sound foundation, on the farm, of knowledge and practice of disease prevention. Proper housing, satisfactory methods of rearing, adequate exercise, as well as feeding, are as necessary to the farm animal as to the citizen, if health is to be maintained.

The direct interest of the Dominions and the role of the Dominion producer in Great Britain's nutritional policy were ably dealt with by Mr. F. L. McDougall (Australia) and by other Dominion representatives. A nutrition policy for the whole Empire is needed. Malnutrition exists in acute forms in various parts of the Empire, and, in fact, in the world at large. An effective endeavour to meet it would solve not only many of the problems of Dominion food producers, but probably also some of the international problems which underlie the present tension. Recent international agreements, far from remedying the acknowledged under-nourishment of half the world, have been agreements to restrict food production, to which Dominion Governments have been hesitant and unwilling partners.

Mr. G. V. Jacks regards the high food output of some of the Dominions as the result of ruthless over-exploitation of stored soil fertility which will have to be paid for in the near future by diminished productivity due to soil exhaustion and soil erosion. In Great Britain and some of the older countries soil conservation, including manuring, draining, proper crop rotation, etc., has been carried out for centuries as a matter of course. The costs of this good farming represent the major part of the difference in costs of production between home produce and similar produce from the Dominions. Prof. S. M. Wadham would not accept this view as applying to Australia, where farmers over the really productive areas are fully alive to the danger of soil exhaustion and have already dealt with it.

There was nearly complete unanimity that lack of purchasing power among the lower income classes of the population is at present the main factor in faulty nutrition. Mr. L. S. Amery, M.P., in introducing the discussion on family allowances, pointed out that a wage system which takes no account of family needs and responsibilities is to-day inflicting grave hardships on millions of malnourished children. He made a convincing case, both on the grounds of simple social desirability and of the future industrial and defence needs of the country, for additional purchasing power for families in which there are growing children. Parents are now finding their own solution to the problem by refusing to have children, and as a consequence we are heading for national catastrophe at a speed measurable by the decline in the birth-rate. Family allowances should effect an appreciable saving on the £300 millions annually which the nation pays for ill-health, not to speak of the new wealth they would add through the positive increase of national efficiency. Mr. Amery's views were supported by Mr. Laurence Cadbury and Sir Kenneth Lee, who emphasized that no time should be lost in getting a national scheme into working order. Where private industrial schemes of family allowances are already in being, increased expenditure on food, that is, improved nutrition of the family, has been shown to be the major result. Extensions of the facilities for provision of free milk and meals direct to school children and to expectant and nursing mothers were advocated by Dr. Stella Churchill, not as a substitute for family allowances but as an efficient supplement to them. She emphasized that money spent on school meals and milk meant less spent on hospital beds, sanatoria, and unemployment in later life due to ill-health resulting from early malnutrition.

The final session of the conference, presided over by Sir Cyril Norwood, linked up the scheme for improved nutrition with education both in the schools and amongst adults. Mr. Lester Smith stated that the colleges at which housecraft teachers are trained are very much alive to their opportunity of improving national nutrition by training their students in what to eat, as well as how to cook it. He made the useful suggestion that school journeys ought to embrace visits to farms, market gardens and orchards, as well as to industrial and manufacturing concerns. The greater use of the radio for the education of the public in matters of health and nutrition was recommended by Prof. V. H. Mottram, and the part played by the women's institutes, whose membership is largely made up of those actually responsible for the purchase and cooking of the family food, was emphasized by Mrs. Henry Haldane. This discussion made it clear that one of the main requirements in our educational system, having in view the objective of an improved national nutritional status, is a greatly increased emphasis on the elements of science and their bearing on health, throughout school life. Through this educational channel every future consumer, housewife, farmer, administrator and statesman has to pass.

The text of the resolution passed at the end of the Conference may be given in full, as it marks a clear but conservative appeal which ought soon to be reflected in Government policy.

"This conference called by the British Medical Association and composed of representatives of Medicine, Agriculture at home and overseas, Industry and Education, is deeply impressed with the importance of nutrition to the national welfare. It urges upon the Government the formulation of a long-term food policy in which the requirements of Health, Agriculture and Industry shall be considered in mutual relation. It is convinced that measures to secure the more ready availability to all sections of the community of foodstuffs which are held to be desirable on nutritional grounds should be accompanied by an educational campaign to encourage their increased consumption."

It is reasonable to expect, in a democracy, that Government policy, particularly when dealing with home needs, will be largely under informed democratic control. If, with proper knowledge of the circumstances, public opinion asks for, and is ready to pay for, improved social conditions, then if democracy means anything at all an honest and pertinacious attempt must be made by executive authority to plan and provide the necessary services. The present international tension, far from excusing any delay in making such provision for an adequate long-term food policy, sharpens the need for it.

The Living Cœlacanthid Fish from South Africa

By Dr. J. L. B. Smith, Rhodes University College, Grahamstown

THE recent discovery of the Coelacanthid fish (*Latimeria chalumnæ* J. L. B. Smith) near East London, as described in NATURE of March 18, p. 455, has aroused great interest. This has partly found expression in numerous requests from all parts of the world for the earliest possible publication of a detailed description. I am able to pursue my investigations only in very limited spare time. The preparation of an adequately illustrated detailed description, under present conditions, will occupy several months. I have therefore decided upon the somewhat unusual procedure of issuing a synopsis of the more important results of my investigations to date. This is in the form of brief outlines without discussion.

Few scientific workers are as fortunate as those who have concentrated upon Coelacanthid remains. The present specimen is a living tribute to the accuracy of their interpretations and reconstructions.

The specimen was somewhat damaged in the trawl, the skin having been broken in several places. Repairs were skilfully executed by the taxidermist.

Skull and head. The skull is unfortunately not quite intact. The basisphenoid and part of the structures around the foramen magnum were removed (and discarded) in mounting. The soft parts of the head appear to have been removed rather roughly. The remaining tissues are in poor condition. Only the structures left intact will be described as fact.

Air-bladder. According to the fairly definite evidence of the taxidermist, this organ was at the very most but feebly ossified.

The scales are cycloid and but little ossified. The proportion of residue after ignition of the unornamented portion of a mid-body scale is very much less than, but qualitatively identical with, that obtained by similar treatment of a teleostean scale. The exposed surface of a scale varies from one fourth to one sixth of the total area. The ornamentation on the caudal scales is in the form of spines, on the rest of the body as tubercles. The tubercles are superficial only; each is set in a thin oval basal plate with corrugated surface. The plates are attached to the scales by tissue which is softened by alkali. The tubercles are of simple structure with a central cavity (see Fig. 1). The lateral line tubes are posteriorly widely bifurcate.

Fins. All the rays of the first dorsal, of the principal and of the supplementary caudal are spinate. A few of the rays of the second dorsal and of the anal are basally feebly spinate. The outer face of the pectoral is spinate. The pelvics only are quite smooth. The bony rays of the dorsal and caudal are articulated. The soft rays are finely articulated to their bases. All rays are composed of two fused lateral segments.

Dermal bones. The cheek-bones are a postorbital, a squamosal, a preopercular and a suborbital (lacrimojugal). On the middle of the lower surface of each cheek is a small bony stud which may be an obsolescent quadratojugal. The opercular is moderate in size. There are two dermal structures in a stage of arrested metamorphosis from scale to dermal bone, which are regarded as subopercular and interopercular respectively.

The intertemporals and the supratemporals appear to be fused. The exposed portion of each frontal is small, oval and flat. These bones are all feebly ornamented. The splenial and angular alone show externally on the lower jaw. The gulars are large and heavy.

Fronto-rostrals. Just beneath the skin there are nineteen bones in this series on each side. One large frontal and a smaller 'pre'-frontal; nine 'rostro-nasals', including a canal-bearing bone (No. 18) often named 'premaxilla' in fossils.

There are eight bones in the 'parafrontal' series, the anterior expanded bones having been named 'antorbitals' in fossils. Besides these nineteen there are the small dentigerous rostral plates. Most of these bones are small and laminate.

Sensory canals. The main canals run much as have been shown in reconstructions. From the lateral line the canal passes through the supratemporals and intertemporals, thence 'parafrontal' to the snout. There it has a small superior median branch. Just below that it gives off an inferior branch which is the infraorbital canal (running through the lateral limb of bone No. 18, which anastomoses with the suborbital). Below this junction is a commissure across the snout. The canal then runs downwards and curves outwards to end on the outer edge of the rostrum around the inner face of bone No. 18. Just behind the frontal is the junction of the infraorbital canal running downwards through the postorbital, which continues through the suborbital to the snout. The anterior limb of the squamosal anastomoses with the

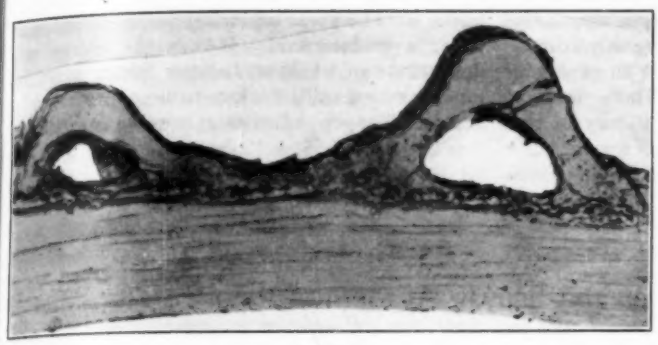

Fig. 1.

SECTION OF A SCALE (×50) OF *Latimeria chalumnæ* J. L. B. SMITH.

postorbital-suborbital anastomosis and carries the jugal canal which continues through the preopercular, thence as a tube in the skin obliquely over the lower outer face of the quadrate. It enters the angular very obliquely and thence runs forward on the lower margin just below the surface to the symphysis. There is a posterior branch on the lower surface of the angular.

Olfactory organs. There are on each side three 'narial' apertures, two conventionally on the side of the snout before the eye, the third on the front of the rostrum. Each opening is the end of a simple tube which leads from a median capsule situated beneath a thin layer of mesethmoidal cartilage. The tubes and the capsule were apparently lined with fine rugose tissue. The capsule is depressed biconical in shape. There is also on each side of the rostrum an infero-lateral nasal tentacle, apparently imperforate. On each side of the snout, inferior and anterior to the median nasal cavity, lies a sac, typically covered below, laterally, and partly behind, by the prevomer, in front by bone No. 18. That bone lies against the outer surface of the hind column of the prevomer. These sacs correspond with the usual 'olfactory capsules', but do not appear to have any external narial opening. The nerve supply to these paired capsules appears to be from the olfactory lobe, and to enter at the upper inner portion of the surface. The nerve supply of the mesethmoidal (pineal ?) cavity appears to come from farther back.

Respiratory organs. The branchial arches and appendages were lost. The arches are stated to have been strongly spinate. Remaining is a spinate epihyal and ceratohyal. Also a superficially ossified tuberculate copula ('tongue'), to which appear to have been attached four branchial arches. There is apparently a hyoidean gill-slit behind the free margin of the 'preoperculum'. The spiracles are small and probably functionless.

The palato-pterygo-quadrate apparatus is massive and typically cœlacanthid. There is no hyomandibular. The prevomer is an unexpectedly solid structure, with the anterior edge of the autopalatine bearing against the hind surface of its outer columnar vertical process. The ectopterygoid overlaps the autopalatine and the pterygoid above.

Upper jaw. Maxillæ are absent, probably also premaxillæ. The upper jaw bears paired dermal plates attached to rostrals, prevomers, palatines and ectopterygoids. These plates are of fused small teeth, and each bears one or two large conical tusks. On the pterygoids and parasphenoid are conical granular teeth. There are two feeble granulate 'epi'-pterygoid areas.

Lower jaw. There is a series of small 'labial' dentate plates on the outer surface of the dentary. Superiorly are four dentate plates on each dentary. The anterior coronoid is small and bears granular teeth as well as several large tusks. The posterior coronoid is large and feebly granulate at the base. The articular-prearticular plate is very long and is granulate anteriorly only.

Several letters from overseas have contained very harsh criticism about the loss of the carcass of this fish. Few persons outside South Africa have any knowledge of our conditions. In the coastal belt only the South African Museum at Cape Town has a staff of scientific workers among whom is an ichthyologist. The other six small

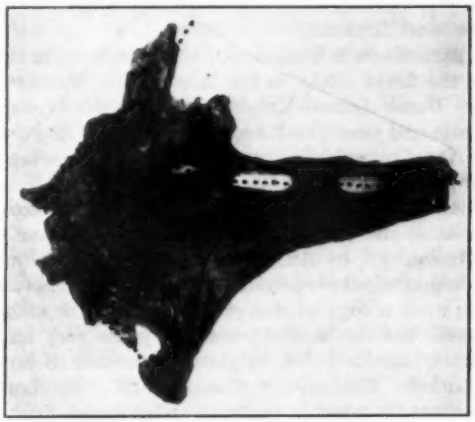

Fig. 2.

ROSTRO-NASAL, No. 18. NAT. SIZE. INNER MARGIN TO THE LEFT. A PIECE OF WHITE PAPER HAS BEEN INSERTED INTO THE CANAL. THE DOTTED LINES SHOW THE COURSE OF SENSORY CANALS. THE RIGHT-HAND LIMB ANASTOMOSES WITH THE SUBORBITAL.

museums serving the coastal area are in extremely poor circumstances, and generally have only a director or curator, who cannot possibly be an expert in all branches of natural history. There are not uncommon fishes in the sea which to any of the latter would appear as strange as, if not stranger than, a coelacanthid. It was the energy and determination of Miss Latimer which saved so much, and scientific workers have good cause to be grateful. The genus *Latimeria* stands as my tribute.

Science at the Royal Academy, 1939

THE one hundred and seventy-first exhibition of the Royal Academy of Arts, which opened on May 1, may be described as conservative artistically, although many will regard it as dull. Whatever trends in art it may reveal, it is remarkable in that it reflects nothing of the alarms and excursions, of political events almost unparalleled, of the clash of arms and the clatter of armoured vehicles that dominated the period in which the painting was done. In the exhibition there are more Elizabethan men-at-arms on one picture than there are modern soldiers in the thousand other works. There is one interior that contains a gas-mask, and, surprisingly, only two or three pictures of refugees.

Few will grieve at this eclipse of war even if only on canvas; but the neglect of belligerent science extends also to the other branches almost as much, and, of the thirteen hundred pictures on show, only about one hundred can be said to include any features of scientific interest and that even in the widest possible sense. Of the nine or ten branches of science which one may allege to be represented, botany and geology appear to be the most favoured.

Agriculture is fortunate in being depicted in two of the finest works in the Academy. "Harvest", by Dame Laura Knight, R.A., with its sun-chequered scene, and James Bateman's "Haytime in the Cotswolds", one of the pleasantest landscapes of the year.

Antiquaries have not far to seek for interest, because the second picture in the first room is "Antiquity", by Alan Beeton, A.R.A. This shows a human skull surrounded by palæoliths and resting upon a copy of *Antiquity*. The work is rather small, but this is compensated by the very large panel, destined for Brighton Grammar School, entitled "Hollingbury Camp, 1929", by Louis Ginnett, in which a party of archæologists is seen at work in the field. The anthropologists are better served, numerically, with a dozen pictures of much interest and considerable artistic distinction. Dame Laura Knight again heads the list with "Gipsy Family", a typically brilliant study which is certain to be acclaimed as one of the pictures of the year. Negro studies are unusually prominent, of which "The Dance, Zululand" (218), "Zulu Woman" (271) and "Zulu Exodus" (278) should be mentioned. A. R. Thomson's "Prince Kessie of Ashanti" and Neville Lewis's "Pondo Youth" are interesting portraits. A more comprehensive work is "The Village in the Jungle", by David Paynter, with a man, a woman and a child in the foreground. In addition there are a study of a Jamaican, Japanese and Chinese portraits, and the delightful Burmese "Ma Seyn Nu", by Gerald Kelly, R.A.

For the botanists, there are a profusion of titles and a riot of colour. Apple blossom, carnations, celery, cinerarias, chrysanthemums, gladioli, lilies, marguerites, roses, tulips and even tobacco flowers (these last by Dod Procter) are only a selection of the delights available. There are also surprises, such as the unexpected "Ilex Tree", a Montallegro landscape by Gerald Kelly. Gilbert Spencer's "Cherry Tree in Winter" and Sallis Benney's "Beech Trees" are other arboreal attractions. There are flowers under their own names, flowers as "Still Life", "Rainbow Colours", "Purity", or just "Flowers". Mr. C. R. W. Nevinson's "Autumn bouquet", and Sir George Clausen's "Roses" are noteworthy, while Miss Grace English contributes a charming variety of colour contrasts in her "Summer Flowers".

Perhaps the most attractive of what may be termed the botanical works is Charles Oppenheimer's "Galloway Woodlands in February". This is a large picture with a background of typical rolling Galloway scenery. The woodland, the picture's main feature, is carpeted with snowdrops and the whole effect makes a charming picture one would like to possess.

Botanical and geological interests are combined in Malcolm Milne's "Val Fleuri", where the gay alpine flowers decorate the high valley. The other pictures which may interest the geologist cover various aspects of the science. Antony Ayrton's "Alpine Landscape" and Hilda Carline's "A Welsh Farm" illustrate a variety of mountain scenery

which is supplemented by the stark but ominous grandeur of "Tulloch, Inverness-shire", by Oliver Hall, R.A. Less rugged aspects of the British countryside are portrayed by Charles Oppenheimer in "The Red Roofs of Whitby", by Miss Amy Browning in "East Anglia" with its very characteristic landscape, and particularly in J. McI. Patrick's quiet "Glamis Village". More informative geologically are Gerald Kelly's "River Lugno from Montallegro" with its clearly-shown valley forms, and Stephen Denison's "Lime Works at Wharfedale" with a quarry section. Sidney Lee, R.A., portrays varieties of bedding, an anticline and other folds, faulting and weathering in "The Road by the Cliff". The meander of a stream is well illustrated in "Pastoral" by George Henry, R.A.

Typical and pleasant coastal, cliff and rock scenery is shown by William Matthews in "Tantallon", by Julius Olsson, R.A., in "Rocks, Antibes", and by A. Raine Barker's "Bridport".

Applied geology is not forgotten, for there are a quarry in Kent (588), the sandpit, Coldharbour (233), and "Cement Works in Surrey", by G. W. Leech. The last picture reveals that the industrial activity is less disturbing æsthetically than might be imagined.

Geologists, geographers and all Americans will be interested by Norman Wilkinson's "San Salvador". In this bay, Columbus landed on October 21, 1492.

If the mineralogists have but two pictures assigned to them, they may be reminded that quality is sometimes better than quantity. In any event, Gerald Brockhurst, R.A., is responsible for the two pictures, both of which are characteristically exquisite portraits. In the first, "Mrs. Hubert Raphael" is portrayed wearing scintillating emeralds and diamonds, while in the second, a portrait entitled "Mrs. Harrison", the amethystine brilliance of necklet, brooch, bracelet and ring is striking and attractive and reveals the masterly skill of the artist in his medium.

The zoologists have been served not quite so lavishly as might have been expected. Mr. Munnings has, however, made his usual and appealing testimonies to equine grace. Miss Winifred Austen, in one of the very few dry points, portrays equine leisure. There are dogs and cats in oils, greyhounds in wash and in bronze, and an antelope in wood. Mrs. Lilian Andrews contributes a swan and family in pastel, and Philip Connard, R.A., shows "Flying Swans", a piece of much distinction. Mrs. Daisy Smith has a delicate water-colour study of kookaburras.

The zoo aspect is supplied by "The Birdhouse" by Percy Shakespeare, with its toucans and parakeets, and "Elephant in Regent's Park" by Henry Carr. "An August Evening in Suffolk", by Bertram Priestman, R.A., with its black-and-white cows, is peaceful; Mr. John Platt's "Bull across the Path", a colour woodcut, is more aggressive.

The march of time in applied science is amply demonstrated by Sir Muirhead Bone's impression in chalk "Building the *Queen Elizabeth*" and Charles Cundall's detailed picture of the launch of the same vessel. The launch of the *Mauretania* is the subject of a wood-engraving by Marjorie Biscomb. The less spectacular sides of industry are represented by "Tin Miners" (383) and "Coke Ovens" (437). The march of science is depicted in "Television Rehearsal" by Harry Rutherford; "Chelsea Power Station" by Gerald Ackermann, and, in a different sense, in "Pylons", where Miss Evelyn Saner shows the feet of the pylons embedded in beautiful highland scenery.

The architecture section contains plans of much interest to many men of science. The new science buildings of the University of Oxford (1046), new or recent buildings of the University of London (1047), the Imperial College of Science (1082) and research laboratories at Berkhamsted (1079) are a few on exhibition.

Portraits of scientific men are not numerous, but the few are well worthy of note. There are Charles Wheeler's bronze bust of Col. W. A. Bristow and the marble bust of the late Sir Robert Mond by William King. Lord McGowan and Lord Weir are the subjects of splendid portraits by Harold Knight, R.A., and T. C. Dugdale, A.R.A., respectively. Malcolm Osborne, R.A., provides a dry point of Prof. Alexander Low, of Aberdeen, while an attractively academic portrait is Edward Halliday's painting of Prof. W. E. S. Turner. Others known in scientific and university circles who are portrayed include John Murray, principal of the University College of the South-West, Exeter (oil painting by R. G. Eves); Dr. A. W. Pickard-Cambridge, vice-chancellor in 1930–38 of the University of Sheffield (oil painting by George Harcourt); Sir William Elderton (oil painting by Harold Knight); the late Dr. A. C. Woolner, vice-chancellor of the University of the Panjab, Lahore (statue by Gilbert Ledward); and the late Lord Moynihan (bust by Sir W. Reid Dick).

If for any reason these aspects of science should prove of little attraction, or should they pall, it may be comforting to know that the Academy also bears testimony to another science, an applied science which is, one believes, still also a pure science, that the month of May particularly welcomes. It is brilliantly dealt with in No. 264, Mr. Charles Cundall's "Test Match at Lord's".

W. E. SWINTON.

Obituary Notices

Sir William Ramsay

BORN at Glasgow on March 15, 1851, and educated at Aberdeen Gymnasium, the University of Aberdeen, St. John's College, Oxford, and the University of Göttingen, William Mitchell Ramsay married early and spent the years 1878–85 in persistent and fruitful travel, first in Greece, then in Asia Minor, with the wise encouragement from 1880 onwards of Sir Charles Wilson, who came from the Survey of Western Palestine to be British consul-general for Anatolia, and with a travelling scholarship and later a research fellowship from Exeter College, Oxford. To the methods of historical geography followed by Hamilton and by Leake, Ramsay added the critical study of local coinage in its topographical distribution, and of the Byzantine and ecclesiastical administrations of Asia Minor, many of the centres and regions of which were inherited from Hellenistic and even much earlier times. Though he travelled in most parts of Anatolia, Ramsay's special region was Phrygia, and his largest coherent publication dealt with its "Cities and Bishoprics" (1895, 1897). For the methods of pioneer research, however, his "Historical Geography of Asia Minor" (1890) is a turning-point, and the patronage of the Royal Geographical Society, which published it, and later awarded Ramsay its Victoria Medal, was never better bestowed.

On the establishment of the Lincoln and Merton professorship of classical archæology and art in Oxford, in 1885, Ramsay was an obvious first choice, and though he passed on in the following year to his old University of Aberdeen, where the facilities for summer travel were greater, he left his mark in Oxford in a succession of classical archæologists and historical geographers, of whom the best known was David Hogarth of Magdalen, his constant travelling-companion. From Aberdeen he continued to direct and advise even after his retirement from the chair of humanity in 1911, when frequent ill-health had been aggravated by reckless exposure to austere conditions of travel. But Ramsay never stopped working: only last summer, on one of his busy visits to Oxford, he was as keen and clear-headed as ever, and full of problems and projects.

Ramsay's output of published work was larger than the titles already noted indicate; the only difficulty was to keep track of it, for his articles, large and small, are scattered among a score of periodicals in both hemispheres. It might have been larger on the geographical side, had he not devoted much of his middle life to more popular expositions of the early history of Christianity, in its relations with the Roman administration: "The Church in the Roman Empire" appeared in 1893, "St. Paul, the Traveller and the Roman Citizen" in 1895, and so on at frequent intervals until 1914.

Other interests arose from Ramsay's intimate experience of Turkish administration, before and after the revolution of 1909, and from his academic activities at Aberdeen. His essay on "The Imperial Peace, an Ideal in European History" (1913) has a fresh significance to-day. On the four hundredth anniversary of his University in 1906, Ramsay was knighted; he was an honorary fellow of Exeter, Lincoln and St. John's Colleges, an original member of the British Academy, and one of the founders of the Hellenic Society. From Pope Leo XIII he received a gold medal in 1893 in recognition of his contributions to the history of Christianity, and other marks of recognition were conferred on him by many universities and academies. J. L. M.

Mr. H. J. George

HERBERT JOHN GEORGE, whose sudden death occurred on April 19 at the comparatively early age of forty-six years, was fellow, tutor in chemistry, and senior bursar of Jesus College, Oxford, and University lecturer in chemistry

George was educated at Cardiff High School and entered Jesus College as scholar in natural science in 1911 after a short period at University College, Cardiff. He gained a first class in chemistry in the June before the Great War broke out. In the War he served in the Royal Welch Fusiliers in Gallipoli, where he was wounded, and then in Mesopotamia and India. Later he was transferred to a department of the Ministry of Munitions.

In 1919 George returned to Oxford as research fellow and lecturer of his old college and became an official fellow and tutor a few years later. Since then Dr. D. L. Chapman and he have been in charge of the teaching of chemistry to the large number of men whose centre was the Leoline Jenkins Laboratories of Jesus College. He was an excellent college tutor; he took great pains with his pupils. As University lecturer he took charge of colloid chemistry and lectured effectively to large classes on this for many years.

George's absorption in his tutorial work and latterly in administrative duties (he was successively librarian, junior bursar and senior bursar of his College and also an Oxford City councillor) did not leave him the time for research work that his abilities warranted. He published work on the adsorption of gases on glass surfaces, on the theory of strong electrolytes, on organic derivatives of thiophosgene and on other subjects. At the time of his death he was working on the constitution of thiophosgene derivatives and on the accommodation coefficients of metals. The results of these researches will be printed in due course. A. S. R.

News and Views

Prof. A. H. Gibson

At a meeting of the Institution of Civil Engineers on May 2, the James Alfred Ewing Medal was presented to Prof. Arnold Hartley Gibson, professor of engineering in the University of Manchester. This is the second award of the medal, which is presented for specially meritorious contributions to the science of engineering. Awards are made by the council of the Institution of Civil Engineers on the recommendation of the presidents of the Institution of Civil Engineers and of the Royal Society. Prof. Gibson was educated at Rishworth Grammar School and at the University of Manchester. In 1909 he was appointed professor of engineering of the University of St. Andrews, where he stayed until 1920, except that during the Great War he served in the Royal Field Artillery and was seconded in 1916 to the Royal Aircraft Factory, where he afterwards had charge of the investigation and research work on aero engines. He was president of Section G (Engineering) of the British Association in 1921, and was a member of the Board of Trade Committee on water-power of the British Isles; of the Air Ministry Engine Research Committee; and of the Severn Barrage Committee. He has written a number of papers on hydraulic engineering, including such subjects as experiments with tidal models, the resistance to rotation of disks in water at high speeds, formation of standing waves in an open stream, wave impact on engineering structures, etc., and, among other awards, has received a Crampton Prize and a Telford Premium for papers published by the Institution of Civil Engineers.

Sir Frederic Kenyon, G.B.E., K.C.B.

The anniversary meeting of the Society of Antiquaries of London on April 27 marked the retirement of Sir Frederic G. Kenyon from the office of president, which he had held since 1934, the statutory period of five years. His term of office has covered a period in the history of the Society of enhanced activity in the field—the excavation of Maiden Castle is a permanent landmark in the study of British prehistory—in the promotion of archæological studies, and in efforts to preserve the antiquarian remains of Great Britain. Sir Frederic's wise leadership and tactful conduct of the Society's affairs have been more than worthy of the great tradition of the long line of his predecessors. His own special interests as an eminent authority on early classical and Biblical texts from papyrological and other sources have in no way been allowed, in the performance of his official duties, to colour, though they may have added inspiration to, his judgment in the broader fields of archæological research. Sir Frederic Kenyon was director and principal librarian of the British Museum (Bloomsbury) from 1909 until 1930. Since his retirement, he has devoted himself strenuously to the advancement of learning and research by taking part in the administration of several learned societies and other bodies, including the British Academy, the Society for the Promotion of Hellenic Studies, and the Society for the Protection of Science and Learning. Sir Frederic is succeeded as president of the Society of Antiquaries by Mr. Alfred William Clapham, secretary since 1929, and secretary of the Royal Commission on Historical Monuments, England, since 1933. Dr. R. E. Mortimer Wheeler will succeed Mr. Clapham as secretary of the Society.

Prof. Karl von Terzaghi

The forty-fifth James Forrest Lecture of the Institution of Civil Engineers was delivered on May 2 by Prof. K. von Terzaghi, who took as his subject "Soil Mechanics: A New Chapter in Engineering Science". Prof. von Terzaghi was born at Prague in 1883 and, after attending the Technical University of Graz, was engaged on projects for hydro-electric developments and other construction-projects in Austria, Hungary and Russia until 1912, when he proceeded to the United States and was chiefly engaged in the study of modern dam construction and problems of engineering geology in connexion with the projects of the United States Reclamation Service. During the Great War he served in the Austrian Army until in 1916 he was transferred to the Technical University of Constantinople to take over the chair of foundation and highway engineering. From 1918 until 1925 he was professor and head of the Department of Civil Engineering of the American Robert College in Turkey. During this period, he was engaged on research in connexion with the physical properties of the most important types of soils and published in 1925 his book "Erdbaumechanik", which is acknowledged as the basis of modern soil mechanics. Between 1925 and 1936, Prof. von Terzaghi was lecturing at the Massachusetts Institute of Technology, the Technical University in Vienna, the Technical University in Berlin-Charlottenburg and at Harvard University. He was president of the first International Conference on Soil Mechanics and Foundation Engineering, which was held at Harvard University in 1936. In addition to his contributions to civil engineering, Prof. von Terzaghi has advanced knowledge in the field of physical chemistry and geology, his best-known work perhaps being his mechanical theory of swelling of gels.

George Miller Beard (1839-1883)

Dr. George Beard, an eminent American neurologist and psychiatrist, was born at Montville, Connecticut, on May 8, 1839, the son of a Congregationalist minister. He studied medicine at Yale, where he qualified in 1862, and four years later joined the staff of the College of Physicians and Surgeons of New York. In the course of his comparatively

short life he engaged in numerous activities, but the subjects in which he was chiefly interested were electrotherapy, hypnotism, functional nervous diseases, longevity and the reform of medical education. As a mental expert he took part in several famous trials and notably that of President Garfield's assassin Guiteaud, whose case he reported in the *Journal of Nervous and Mental Disease* of January 1882. Of his numerous other writings the most important are "Medical and Surgical Electricity" written in conjunction with A. D. Rockwell (1875), "Neurasthenia (Nervous Exhaustion) with Remarks on Treatment" (1879) and "American Nervousness: Its Causes and Consequences", which was translated into German. He also contributed many articles to the *North American Review* in which he popularized scientific knowledge, and was the founder of the *Archives of Electricity and Neurology*, which had only a short existence (1874–76). He was one of the originators of the National Association for the Protection of the Insane and of the American Neurological Society. He died on January 23, 1883.

Preservation of Wild Geese and Wild Duck

THE Wild Birds (Ducks and Geese) Protection Bill, which passed its final stages in the House of Lords on May 2, and will come into force as an Act on August 1, marks a decided step forward in the efforts being made to conserve the world's stock of Anatidæ. During its passage through Parliament, the Bill has been strengthened by amendments put forward by the promoters, the International Committee for Bird Preservation (British Section). The Bill, when first introduced in November 1938, was framed with the view of securing its rapid passage as an unopposed measure; but as opposition was encountered the promoters, while compromising on certain points, were able to gain considerably on others. The main terms of the Bill in its final form are: the extension of the 'close season' for wild geese and wild duck (of any species whatsoever, the merganser and goosander only being excepted) from February 1 to August 11; the addition of wild geese of all species to the schedule; and the prohibition of import of wild geese and wild duck from February 1 to August 11. Heretofore wild duck have enjoyed the benefit of being scheduled birds (by the Act of 1880), that is, protected from owners and occupiers of land on their own land—during the close season—but wild geese have not. The new measure, therefore, greatly increases the protection afforded to wild geese. However, in order to safeguard the interests of farmers, for, in certain cases, wilfd geese are considered to damage crops, a clause gives power to county councils to apply to the Secretary of State for Home Affairs to remove wild geese from the schedule in any area in the county concerned.

COUNTY councils also have the right to make similar application to extend the shooting season for wild duck and wild geese on the shore and land contiguous to it to a date not later than February 21. This clause is admittedly a concession, but the duck it will affect are mainly widgeon. Though quite a number of widgeon nest in Scotland, their breeding season is during the second half of May, and the majority of birds are those passing through on their way north to breed, where the season is later still, usually not until June. Allowing these birds to be shot until a later date would not have so much deleterious effect as would the shooting of earlier nesting species. Further, county councils retain the right to make application to extend the statutory close season, but *not*, as heretofore, to diminish it. The prohibition of import of wildfowl during the breeding season is an extremely important point, for it cuts off the demand from the London market of ducks caught in decoys in certain European countries at this time. Thousands of duck have been caught annually in decoys on the Continent during the breeding season, and this has been a serious drain on the stock of European wildfowl; by means of the new Act this drain will now be effectively curtailed.

Sir Ambrose Fleming and the Thermionic Valve

WELCOMED by the Provost (Sir Allen Mawer), Prof. R. O. Kapp and an appreciative audience, Sir Ambrose Fleming once again visited, on April 27, University College, London, where for more than forty years he occupied the chair of electrical engineering. The occasion was the formal presentation to the College by Mr. R. McV. Weston of a convenient exhibition case to hold early Fleming and other valves in the possession of the Electrical Engineering Department, including those presented recently by Mr. Weston and Sir Ambrose himself. After the case had been unveiled, with the appropriate aid of torch, photocell, valve amplifier and relay, Sir Ambrose gave a remarkably clear and vigorous address on the history of the valves displayed. The story began when he investigated the reason for a white line of clearer glass in the deposit of evaporated carbon from the filaments of early Edison-Swan lamps after many hours of use. He concluded that some of the carbon particles became charged and were driven off with high velocity from one end of the filament, throwing a 'shadow' of the other side of the hairpin loop on to the glass. Edison, in America, hung a metal plate within the loop, and found that when connected through a galvanometer to the positive end of the filament, a current flowed to the plate, but not when connected to the other end.

EDISON left the subject with the discovery of this effect; but Fleming continued his experiments, which led to the construction of a bulb containing a filament at each end. With one filament hot, negatively charged particles would flow through the bulb to the other filament, if the latter was a few volts positive, but not if negative. This was the first 'rectifying valve', and here Sir Ambrose left the work to concentrate on his teaching duties. It should be emphasized that this work was before the discovery of the electron by Sir J. J. Thomson. During the next decade, Sir Oliver Lodge, Marconi and others were

experimenting with wireless telegraphy, using coherers and magnetic detectors. In 1899, Sir Ambrose was appointed scientific advisor to the Marconi Company, and soon came up against the problem of finding a more stable detector, suitable for operating a morse printer. In November 1904, he removed from the cupboard the rectifying valve, set up a high-frequency generator on the lecture bench, and was successful in using for the first time a thermionic valve detector of electromagnetic radiation. Very soon, special valves were being designed for this purpose. The cabinet of valves, occupying a prominent position in the College Engineering Department, will be a constant reminder of Sir Ambrose Fleming and of the rapid developments during the last thirty-five years.

Million-Volt X-Ray Tube

A PAPER on a million-volt X-ray tube which has been installed and is in operation for treatment at St. Bartholomew's Hospital was read before the Institution of Electrical Engineers by Allibone, Bancroft and Innes at a meeting held on April 13. A description was given of the design, equipment, lay-out and operation of the unit. Briefly, it may be said that the tube embodies the principles of the all-metal X-ray tube designed by Dr. Allibone for lower voltages, and the elaboration set out in the present paper arises from the scale of voltages used. The X-ray tube consists of a steel tube 14 in. in diameter and 17 ft. long; the central portion of it, from which the X-ray beam emerges, traverses the treatment room and projects into each generator room. The generator rooms each house 500 kv. D.C. generators. The X-ray tube and thermionic rectifiers used in the D.C. generators are evacuated continuously by oil diffusion pumps, and the whole apparatus is readily demountable. Removable filament assemblies are fitted to the rectifiers and facilitate rapid replacement of filaments; a special cathode with six interchangeable filaments has been developed for the X-ray tube to avoid frequent admission of air into the tube during filament replacements. The tube is now used continuously at 1000 kv. and has been operated experimentally at 1100 kv. Curves relating X-ray output with voltage and filtration by metallic filters are given, and a radiograph is included to illustrate the capabilities of the tube if applied to industrial radiography.

Revised Broadcasting Wave-Lengths

AFTER sitting for some six and a half weeks during March and April at Montreux, the international broadcasting conference has terminated with the issue of a plan for the revision of the wave-lengths and power of broadcasting stations in the European zone, which includes Iceland and the Mediterranean basin. The 'Montreux Convention', as it is known in broadcasting circles, was signed by the representatives of thirty-one States, and provides for certain changes in wave-length and power of European broadcasting stations to come into effect on March 4, 1940. The changes to be made affect all the British stations, including those at Start Point, Clevedon and Norwich, which are not yet in regular operation. Details of the changes indicating the manner in which they may affect British listeners to broadcasting were outlined in recent issues of *The Times* and the *Wireless World*. Power limitations have been imposed by the Convention, varying from 500 kw. for long-wave stations by day only to 10 kw. for stations operating on the shortest wave-lengths of the medium wave-band. Although Great Britain has been allocated the exclusive use of only three wave-lengths, it is pointed out that our geographical position on the outer fringes of Europe is such that we can share wave-lengths with other countries in a way that would be impracticable in central Europe. Generally speaking, it may be said that the plan provides an improved state of affairs in the long-wave band, and also in the middle-wave band so far as home reception is concerned. In view of the developments of broadcasting, and the increase in number and power of stations during recent years, the Montreux Conference would appear to have achieved a satisfactory result if it has succeeded in avoiding any deterioration in the service now provided in all countries.

Further Extension of the Ashmolean Museum, Oxford

A FURTHER extension of the Ashmolean Museum in the University of Oxford was opened by Lord Crawford and Balcarres on April 25, towards the cost of which the Worshipful Company of Drapers has contributed the sum of £10,000. The Master of the Company, Sir Auston Harris, in the course of his remarks at the opening ceremony, said that while the City Companies can no longer vie with the munificent gifts of wealthy Englishmen, or with great American corporations, this gift would serve as another mark of the respect and esteem which an ancient City Company bears towards an ancient University. The extension is on the north-east corner of the building, and provides for the Museum's Egyptian collections, which it has now been possible to arrange in chronological order, a lecture room, and a storage basement. A set of smaller rooms on six floors has been built between the new wing and the Taylorian Institution. Here are students' workrooms, a room for the keeper, Mr. E. T. Leeds, and rooms for the preparation of exhibits. This is the third extension added to the buildings in five years, and marks the final stage in the plans for the enlargement of the accommodation to relieve pressure on the Museum's space. The first extension was the provision of the Weldon Gallery in 1934, and the second was the addition of the Griffith Institute, which was opened in January last. The gallery in which the Egyptian collections were formerly housed has now been divided by screens into three rooms, to be devoted respectively to the European prehistoric period, covering the stone and bronze ages, the Minoan collection, by the gifts of Sir Arthur Evans now the finest in existence, and the Near Eastern Collections.

A Cornish Headland Fortified Site

SOME interesting results, it may be expected, will emerge from an archæological exploration of a Cornish headland fortified site, which has been in progress under the direction of Dr. R. E. Mortimer Wheeler during the fortnight ending on April 24, when digging ceased. The site comprises a series of hut-circles within an enclosed area on Gurnard's Head, near Falmouth. The purpose of the investigation is to endeavour to trace evidence of connexion in the first century B.C. between these Cornish headland forts and the contemporary or earlier inhabitants of the sites on the south-west coast of Brittany examined by Dr. Wheeler's expedition last year. The fortified enclosure here is formed by three ditches running across the neck of the peninsula, protecting it from attack on the landward side. The hut-circles, according to a report in the *Western Independent* of April 23, begin close to the inner rampart, of which the wall was in three steps, recalling the structure of the hill-fort of Kercaradec, near Quimper in Brittany, which has been described by Dr. Wheeler as fortified by three lines, with an inner rampart faced by dry stone walling, of which the innermost facing was stepped in three stages and surmounted by a timber palisade. A feature of the construction of the hut-circles, which is said particularly to have impressed the excavators, is the large size of the placed wall-stones. The discovery of a spindle whorl of pottery attests the presence of women, even though the hut-circles do not appear to have been places of permanent occupation. A number of sea-rolled stones include sling-stones; and two sherds of pottery show fragments of the spiral decoration of the first century B.C. A sherd with 'duck' pattern recalls a find at Chun Castle, four miles away, made by Mr. Leeds in a fort resembling the forts of northern Spain, and interpreted by him as a relic of connexion due to ancient metal working.

Dermatology and Folk-lore

AT a meeting of the St. John's Hospital Dermatological Society on April 26, Dr. J. D. Rolleston read a paper on this subject. After a few remarks on folk-lore in relation to skin diseases generally, in which he alluded to their supposed causation, prophylaxis and treatment, he dealt with the individual skin diseases with which folk-lore was most concerned. No skin disease, he said, or indeed disease of any kind, had received so much attention in folk medicine as warts, the literature on the subject even exceeding that on whooping cough or 'ague'. Next in importance in popular estimation came shingles, and then baldness, boils, burns, cosmetic defects such as freckles and wrinkles, congenital abnormalities, ringworm, urticaria, cancer of the skin and chilblains, in the order named. As in his previous paper on "Folk-lore and Medicine" (see NATURE, January 21, p. 111) Dr. Rolleston discussed the various preventive and therapeutic measures used in folk-lore under the following headings: (1) transfer of the disease to other persons, animals or inanimate objects; (2) animal and plant remedies; (3) religious influences, including invocations to patron saints; (4) the healing power of water in the form of wells, springs, fountains and streams; (5) the mystical power of odd numbers; (6) repellent and disgusting remedies, including coprotherapy, for the object of driving out the evil spirit supposed to be the cause of the disease; (7) miscellaneous cures, such as the doctrine of signatures, the influence of the moon and fasting saliva.

Archæology and the Bible

THE striking manner in which post-War archæological investigation in the Near and Middle East has contributed to Biblical studies is concisely reviewed by Prof. S. H. Hooke in "Archæology and the Old Testament" (London, Thomas Murby and Co., 1938. Pp. 32. 6*d*. net), one of an excellent little series entitled "After 400 Years", which deals with various aspects of the Bible in the light of modern scholarship. Whereas at one time the efforts of the archæologist in the interests of Biblical studies were directed mainly to the search for texts which might confirm the Hebrew record, modern excavations in Mesopotamia, in Syria and in Palestine or Egypt have not merely provided a measure of corroboration for the Biblical narrative of the course of events, but also—and to many this may seem of major importance—they have given the Scriptural records a historical setting and cultural background, both within the boundaries of Palestine and in relation to neighbouring peoples and empires, which has elucidated a multitude of obscurities in the Biblical historical narrative as well as in tradition, in ritual and in belief. Thus Prof. Hooke, speaking of the recent investigations of Sir Leonard Woolley at Ur, of Dr. Dorothy Garrod in Palestine, and of others elsewhere, is able to say that "during the last thirty years archæology has reconstructed the stage . . . on which the drama of the history of the Hebrew people was played . . . those great ancient civilizations, which surrounded and profoundly influenced that small country of Canaan". Making this his starting point, he passes on to show the manner in which the attitude of instructed opinion on Biblical questions has been profoundly modified by recent discovery in regard to the history of writing and its beginnings, early law and legal codes, the conquest of Palestine, the religion, ritual, and mythology of Canaan, the condition of Palestine in the time of the Lachish letters, the Hittites and their empire, and like matters.

New Air Speed Record

THE absolute air speed record of more than 463 miles an hour, set up by Herr Dieterle in Germany recently (reported in NATURE of April 15, p. 633), has now been broken. Herr Wendel, flying a Messerschmitt Me.109.R. fighter fitted with a Mercedes-Benz engine and a V.I.M. metal airscrew, claims to have attained a speed of 755 kilometres (469·11 miles) an hour. Reports claim that this aircraft is a new type of fighter, and the published rating of the engine is

1,175 horse-power. A previous edition of this machine, the Messerschmitt Bf 109, with an engine of 950 horse-power, is credited with a maximum speed of 315 miles an hour, and this performance is about what might be expected for this class of fighter aeroplane with its necessary equipment. The great increase in speed of the new machine with so small an increase in rated power suggests that the term 'fighter' is a misnomer, and that the machine, while its design may be based on such a class, is almost certainly a specially fitted one which would be impracticable for the carrying of standard military equipment. Also the engine must have been giving considerably more than its rated power, which suggests that it was running under conditions that could not have been maintained in practical service work. Although this does not mean that the German Air Force now possesses a single-seater fighter of such a performance, the setting up of the record is an achievement upon which the German aircraft industry is to be deservedly congratulated.

Engineering Research at the City and Guilds College

A SHORT general account has been issued by the City and Guilds College, Imperial College of Science and Technology, of researches in progress at the College which are mainly financed by an annual grant of the Clothworkers Company given to further engineering research. This research report for 1937–38 contains a brief account of the fluid motion research in the Department of Aeronautics. In the Department of Civil Engineering experimental work on the static loading of a 10-ft. span voussoir arch has been completed which has shown that the generally accepted method of design is unduly pessimistic since even lime mortar joints can resist some tensile stress, and with cement mortar the first sign of failure is at a considerably higher load than that given by the classical theory. An investigation of stresses in suspension bridges is in progress, and in addition to various structural researches the problems of river meander, tidal phenomena, wave research and tests of bituminous jointing compounds for liquid-retaining concrete structures have received attention in the Department. The Department of Electrical Engineering has constructed a high-frequency Wheatstone bridge and also a high-frequency Schering bridge. Besides its work on heat transmission, the Department of Mechanical Engineering has been responsible for work on heat dissipation from surfaces by natural convection in gases and liquids, including mercury, on heat transfer from gases flowing through packed solids, radiation from non-luminous gases, convection in pipes at low velocities, evaporation and convection, gumming tests on lubricating oils with the Helmore-Griffiths oil-testing machine, the mechanical properties of metals near their melting-point and on internal combustion engines.

Post-graduate Studies in the University of Bombay

THE Deccan College, which was abolished some years ago, is apparently to be revived by the Government of Bombay as an institution for post-graduate work in arts. The scheme has given occasion to a candid friend of higher education in India in general and the University of Bombay in particular to direct attention in an article recently published in the *Mahratta* to some of its shortcomings, and to make suggestions for ensuring that they do not vitiate the work of the proposed Deccan College Institute. The existent provision for post-graduate instruction in the University is described as farcical and the standards of undergraduate work in India generally, and particularly in Bombay, as so low that the attainments of a B.A. or B.Sc. are, more often than not, at or below the level of a good freshman in a British university. "Research" or "direction of research" is too often a pretext for shirking genuine work, and much nonsense is talked about the evils of "over-lecturing" and "spoon-feeding". What is wrong with higher studies is a deficiency of strenuous, orderly, conscientious, healthily motivated work under competent direction and close supervision. It is suggested that the new Institute should make good the deficiency so far as possible by putting graduates through a discipline which they ought to have already experienced, including the regular and frequent submission of written work and its patient examination by instructors intent on eliminating the indolent and incapable. The proposed fields of study are mathematics, philosophy, English, philology, Indian languages, history and economics. In view of the growth of unemployment among the educated classes and the evils attendant on the existence of an unemployed and unemployable university proletariat the comment suggests itself: higher education for—what?

The Geographical Laboratory

A USEFUL pamphlet by Prof. Griffith Taylor, entitled "The Geographical Laboratory" (University of Toronto Press, 1938), sketches with a varying amount of detail a three years course in geography for North American universities. Much of it, however, would be equally applicable to students in Europe, and there should be no difficulty in adapting the more special American section to other requirements. The course is carefully graded, leading from map reading, simple surveying and standard projections to the treatment of statistics, the study of graphs and correlation coefficients and problems of navigation. The matter for the allied lecture courses is also indicated. The courses express an ideal which in their comprehensiveness might be difficult of fulfilment, but the pamphlet should certainly prove a useful guide to both teachers and students.

Conference on Photography

THE Manchester and District Branch of the Institute of Physics is arranging to hold a conference on "Photography" on July 3–4 in the Physics Department, the University, Manchester. The meetings will begin at 2.30 p.m. on the first day and will terminate at 4.0 p.m. on the second day; they are open without formality of any kind to non-members as well as to members of the Institute of Physics. The events

already arranged include lectures and discussions on theories of the photographic latent image, experimental work bearing on these theories, important properties of photographic materials, applications of photography to scientific research, and colour photography. Lectures will be given by Prof. N. F. Mott, Dr. W. F. Berg, Dr. J. C. M. Brentano, Dr. D. A. Spencer, Dr. E. R. Davies and Dr. S. O. Rawling. Full particulars will be announced at a later date.

The Royal Institution

THE anniversary meeting of the members of the Royal Institution was held on May 1, during which the annual report of the visitors was received and adopted. Matters mentioned in the report included the appointment of Prof. W. L. Bragg, Cavendish professor of experimental physics at Cambridge, to succeed the late Lord Rutherford as professor of natural philosophy in the Institution, and of Prof. E. N. da C. Andrade to succeed Sir Henry Miers as chairman of the Library Committee. A legacy of £1,000, free of duty, has been received from the late Mr. P. A. Molteno, and the first payment has been made by the Asiatic Petroleum Co. Ltd. of an annual grant of £100 in aid of the researches at the Institution. The following officers were elected at the meeting: *President*, Lord Eustace Percy; *Treasurer*, Sir Robert Robertson; *Secretary*, Major Charles E. S. Phillips.

Recent Earthquakes

Two earthquakes of considerable severity have been recorded by observatories in England recently. The first was recorded at Kew on April 21 at 4 h. 39 m. 56 s. (dilatation) and the second on April 23 at 16 h. 32 m. 24 s. G.C.T. The former is thought provisionally to have had an epicentre in north-eastern Asia, and to have had a depth of focus of some 500 km.; its occurrence is confirmed by a message from Dr. O. Somville of the Royal Observatory at Uccle, Belgium.

Comet Jurlof-Achmarof-Hassel (1939 *d*)

MUCH interest was shown in this comet, which was easily visible in field glasses, and it has been under observation since April 15, when it was discovered, until the present time. It had a tail about 4° in length, but on April 22 this suddenly disappeared. Observers are certain that the tail was not diminishing in brightness an hour before its disappearance, and it is remarkable that it should have vanished so suddenly. It is receding from both earth and sun and so is diminishing in brightness; but it may be possible to find it with a small telescope until the middle of May. An ephemeris for a few dates is given below:

	R.A.	N. Dec.
May 7	5h46·3m	32° 01′
9	5 54·8	30 38
11	6 02·1	29 31
13	6 08·3	28 08

Its distances from the earth and sun on May 9 are 116 and 78 million miles respectively.

Announcements

PROF. EMILE DE WILDEMANN, professor of botany and agriculture in relation to the Belgian Congo in the Colonial University of Belgium, Anvers, has been elected *correspondant* for the Section of Botany of the Paris Academy of Sciences, in succession to the late Prof. V. Grégoire.

THE following officers of the North East Coast Institution of Engineers and Shipbuilders have recently been elected: *President*, Major T. Russell Cairns; *Vice-Presidents*, Mr. Robert Haswell, Comdr. E. R. Micklem, Mr. H. B. Robin Rowell; *Honorary Treasurer*, Mr. W. H. Pilmour; *Secretary*, Mr. T. S. Nicol.

THE Challenger Society for the Promotion of the Study of Oceanography will be making further grants in aid of research during the current year. The general committee is prepared to consider applications for small grants in aid of research in marine biology, the work preferably to be carried out at one of the recognized laboratories. Applications, accompanied by details of the proposed research, should reach the Honorary Secretary, Mr. J. R. Norman, British Museum (Natural History), S.W.7, before May 22.

IN compliance with the requirements of a gift under the will of the late Francis Amory, of Beverly, Massachusetts, the American Academy of Arts and Sciences announces the offer of a septennial prize, to be known as the Francis Amory Septennial Prize, for outstanding work with reference to the alleviation or cure of diseases affecting the human genital organs. If there is work of a quality to warrant it, the first award will be made in 1940. The total amount of the award will exceed ten thousand dollars, and may be given in one or more awards. Further information can be obtained from the Amory Fund Committee, c/o the American Academy of Arts and Sciences, 28 Newbury Street, Boston, Mass.

CATALOGUE 51, published by E. P. Goldschmidt and Co. of 45 Old Bond Street, London, W.1, includes a number of works illustrating the history of science and a few rare and important old medical books. The scientific works consist of first editions of books by Brahe, Copernicus, Galileo, Hutton, Huyghens, Kepler, Malpighi, Mendel, Newton and Pasteur, while the medical works are represented by first editions of Auenbrugger, Claude Bernard, Lister, Purkinje, Semmelweis and Steno. John Raphael Smith's oil portrait of Edward Jenner (1800) is also included, and modern but rare works such as the first edition of Freud's "Traumdeutung" (1900), Einstein's inaugural thesis (1905), Sir Charles Sherrington's "Integrative Action of the Nervous System" (1906), and Johannes Schmidt's "Contributions to the Life-History of the Eel" (1906). The catalogue is well illustrated and annotated.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 766.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Emission of γ-Rays from Fluorine Under Proton Bombardment

THE work of many experimenters[1] has proved that the excitation curve of the γ-ray emission from fluorine under proton bombardment exhibits a series of sharp resonances. Such resonant effects in the emission of γ-radiation are usually ascribed to the process of proton capture, and on this basis the γ-radiation from fluorine would be ascribed to the reaction :

$$^{19}F + {}^{1}H \rightarrow (^{20}Ne^{*}) \rightarrow {}^{20}Ne + h\nu \quad . \quad . \quad . \quad (1)$$

Measurements of the energy spectrum of the radiation reveal the presence of a single line[2] of quantum energy $6{\cdot}0 \times 10^{6}$ ev.[3], whereas the total energy available according to reaction (1) is $13{\cdot}1 \times 10^{6}$ ev. for the lowest resonance at 330 kv. This discrepancy could be explained if the de-excitation of the excited $^{20}Ne^{*}$ nuclei occurred by successive emission of two quanta of about 6×10^{6} ev. energy, the full transition being forbidden, and we have therefore sought for evidence of the simultaneous emission of γ-ray quanta. Using a pair of γ-ray counters exposed to the radiation, the rate of occurrence of coincident impulses was found to be 0·2/min., whereas the minimum rate to be expected on the above view was 35/min. It seems therefore improbable that equation (1) provides the correct explanation of the γ-ray emission, even if the de-excitation occurred in successive stages.

Burcham and Smith[4] have shown that in the bombardment of fluorine with protons an emission of α-particles of range 0·8 cm. takes place and that, for bombarding energies in the region of the first resonance of the γ-ray excitation curve, the α-particle emission exhibits similar resonant excitation.

A possible explanation of all of the foregoing facts may be obtained by assuming that the emission of a quantum of energy $6{\cdot}0 \times 10^{6}$ ev. from the intermediate $^{20}Ne^{*}$ nucleus results in the formation of a less excited $^{20}Ne^{**}$ nucleus which afterwards disintegrates into ^{16}O and ^{4}He nuclei. The resonant features of the γ-ray emission might then have their normal explanation, whilst the observed resonant effect in the α-ray emission would be explained by the assumption that the $^{20}Ne^{**}$ nuclei which are unstable with respect to the emission of α-particles are only formed as a result of the γ-ray emission.

On this view, however, as also for the process (1), it is to be expected that the quantum energy of the emitted γ-radiation would increase by finite steps as the bombarding energy of the protons is increased to such values that the γ-ray emission occurs from the higher levels of excitation of the intermediate nucleus. By placing aluminium screens between a pair of Geiger-Müller counters, we have determined the maximum range of the secondary electrons projected by the γ-radiation. The measured end-point values at bombarding voltages of 330 kv., 670 kv. and 860 kv. indicated values for the quantum energy of the γ-radiation identical within the experimental error of ± 50 kv. Further evidence that the quantum energy remains unchanged at these resonances has been obtained by the use of a recently constructed magnetic γ-ray spectrometer. By this method the *relative* values of the quantum energy were the same within the experimental error of 100 kv. The absolute value obtained for the quantum energy was $6{\cdot}5 \times 10^{6}$ ev. In view of these facts, we suggest that the γ-ray emission is the result of the formation of excited $^{16}O^{*}$ nuclei according to the process :

$$^{19}F + {}^{1}H \rightarrow (^{20}Ne^{*}) \rightarrow {}^{16}O^{*} + {}^{4}He \rightarrow {}^{16}O + {}^{4}He + h\nu, \quad (2)$$

the same excited state of ^{16}O (at $6{\cdot}5 \times 10^{6}$ ev.) being produced for each resonance of the γ-ray excitation curve.

The total energy which is available, according to equation (2), as kinetic energy of the ^{16}O and ^{4}He nuclei is $8{\cdot}5 \times 10^{6}$ ev. when the ^{16}O nucleus is formed in its ground state and resonant excitation of the α-particles of maximum energy is not therefore to be expected. When, however, the ^{16}O nucleus is left with an energy of excitation of $6{\cdot}5 \times 10^{6}$ ev., the kinetic energy of the resulting particles is only $2{\cdot}0 \times 10^{6}$ ev. and this value is sufficiently low to suggest that broadening of the resonant level due to this α-particle emission would not destroy the resonant features.

The resonant nature of γ-ray emission is usually explained by assuming that the proton is captured into a state from which de-excitation by the emission of an α-particle with the full energy of excitation is for some reason forbidden, the intermediate nucleus remaining excited until de-excitation by the emission of γ-radiation can occur. The above results show that these resonant states of $^{20}Ne^{*}$, from which the emission of an α-particle with the full energy is forbidden, decay by the emission of an α-particle of lower energy, rather than by the emission of γ-radiation, the residual oxygen nucleus being left in an excited state. It is probable, therefore, that the time required for this emission of a low-energy particle is considerably shorter than the time required for the emission of γ-radiation, but not so short that the resonant features could not occur. The delay needed for this latter condition may crudely be pictured as the time of leakage of the α-particle through the potential barrier of the excited $^{16}O^{*}$ nucleus. It has been shown that the height at which the penetration occurs is, for the resonance at a bombarding energy of 330 kv., about $2{\cdot}0 \times 10^{6}$ ev. above the virtual ground state of the excited $^{16}O^{*}$ nucleus, and one might therefore reasonably expect a further energy range of about 2×10^{6} ev. in which the breadths of the resonant

levels show a progressive increase with bombarding energy as the top of the potential barrier is approached.

It is interesting to notice that whilst resonant phenomena associated with the emission of particles from elements bombarded with α-particles have frequently been observed, such processes have hitherto, with one exception, not been found for bombardment with protons or deuterons.

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April 22.

[1] Hafstad and Tuve, *Phys. Rev.*, **48**, 306 (1935). Bernet, Herb and Parkinson, *Phys. Rev.*, **54**, 398 (1938). Curran, Dee and Petrzilka, *Proc. Roy. Soc.*, A, **169**, 269 (1938).
[2] Halpern and Crane, *Phys. Rev.*, **55**, 206 (1939).
[3] Deisasso, Fowler and Lauritsen, *Phys. Rev.*, **51**, 527 (1937).
[4] Burcham and Smith, NATURE, in the press.

Production of Neutrons by the Fission of Uranium

As a result of the discovery of the fission of the uranium nucleus after absorption of a neutron, we have made experiments to see if other neutrons are emitted in the process, and to measure their number. The results are comparable with those recently published by Joliot[1] and others.

Our apparatus consists of four concentric copper spheres (*a*), (*b*), (*b′*), (*c*) of radii 7·5, 10·5, 11·5, 12·5 cm., at the centre of which a source of radon plus beryllium of the order of 200 mc. was placed. The space between (*b*) and (*b′*) was an air gap left for structural reasons. In the first set of experiments, the inner sphere (*a*) was filled with paraffin wax and the space between (*b′*) and (*c*) with boron carbide. The apparatus was placed in a tank filled with water, and the activity detected by a dysprosium detector about 15 cm. from the surface of the outer sphere. Measurements were taken with the space between (*a*) and (*b*) empty, giving a count v, and full of uranium oxide (U_3O_8), giving a count u. In the second set of experiments the paraffin wax was removed, and the source surrounded with cadmium so that only fast neutrons were used. Again, experiments were made with, u_1, and without, v_1, the uranium oxide. Finally, experiments were made with the tank empty and the paraffin wax in place, but no boron carbide, to determine the absorption of the layer of uranium oxide for slow neutrons.

We considered that the production of neutrons might be due either to the slow or fast neutrons, or to both, and our experiments enable us to separate the two effects.

We found the following counts: $u = 0{\cdot}81 \pm 0{\cdot}015$; $v = 0{\cdot}75 \pm 0{\cdot}02$; $u_1 = 1{\cdot}24 \pm 0{\cdot}03$; $v_1 = 1{\cdot}11 \pm 0{\cdot}025$; while the absorption for slow neutrons corresponds to a cross-section of $5{\cdot}9 \times 10^{-24}$, assuming a cross-section[2] of scattering of the order of 40×10^{-24} for these neutrons.

Let ν be the number of fast neutrons produced by the fission of one uranium nucleus when caused by a slow neutron, and σ_f the cross-section for this process, and ν^1, $\sigma^1{}_f$ be the corresponding quantities for fission caused by fast neutrons; let σ_c be the effective cross-section for all capture processes, including fission and resonance, for slow neutrons (for our purposes the resonance neutrons count as slow, but owing to their small 'numerosity' the effective cross-section for the resonance process will be considerably less than the cross-section at resonance (25 volts)). Let σ_c' be the corresponding quantity for fast neutrons. We find the following results: $\nu'\sigma_f' - \sigma_c' = (4{\cdot}0 \pm 1) 10^{-24}$ cm.^{2}; $\nu\sigma_f = (2{\cdot}1 \pm 1{\cdot}6) 10^{-24} + 0{\cdot}78\sigma_c'$; $\sigma_c = (5{\cdot}9 \pm 1) 10^{-24}$. In calculating $\nu\sigma_f$ we have assumed that the number of fast and slow neutrons which reach the surface of our paraffin sphere are respectively 50 per cent and 20 per cent of the number emitted by the source[3].

It will be seen that there is a net increase in the number of fast neutrons considered separately. As regards the slow neutrons the result is less certain; there is apparently a decrease for these neutrons considered separately unless σ_c' is taken as at least 3×10^{-24}. We believe, however, that our method tends to give too large a value for σ_c owing to scattering. It is in fact larger than that used by Joliot in his recent paper[1], $(8{\cdot}7 - 1{\cdot}2) \div 1{\cdot}6 = 4{\cdot}7$. If we assume Joliot's result is due to fission by slow neutrons, the value of σ_c' becomes at least 4×10^{-24}.

We hope shortly to make similar measurements with thorium.

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April 28.

[1] v. Halban, Joliot and Kowarski, NATURE, **143**, 470, 680 (1939). Haenny and Rosenberg, *C. R.*, **208**, 898 (1939). Dodé, v. Halban, Joliot and Kowarski, *C. R.*, **208**, 995 (1939).
[2] Dunning, Pegram, Fink and Mitchell, *Phys. Rev.*, **48**, 265 (1935)
[3] Fink, Dunning and Pegram, *Phys. Rev.*, **49**, 642 (1939); and "Kernphysik", 18 (Springer, 1936).

Absorption Method for Determining the Range of Recoil Atoms

THE determination of the recoil ranges of atoms resulting from radioactive disintegrations has hitherto been restricted almost entirely to gases, on account of the extremely short range of recoil atoms in solids; in silver, for example, the range of α-particle recoil atoms is of the order of a few hundred angstroms, whilst that of β-particle recoil atoms is many thousand-fold less. It is clear, therefore, that absorption measurements and subsequent range determination in solids are possible only if the thickness of the absorbing layer can be varied by amounts corresponding to a small number of molecular layers. It occurred to us that the built-up molecular films prepared by the method of Blodgett and Langmuir[1] might serve as adjustable absorption screens of this kind; we have now demonstrated the feasibility of this idea and have obtained preliminary quantitative results.

In the first instance, we have confined our attention to α-particle disintegrations which immediately precede a β-particle disintegration, and have devised two methods, (1) suitable for thorium A, radium A and actinium A, and (2) convenient for thorium C, radium C′ and actinium C.

In method (1), a built-up film is prepared, containing a known number n of molecular layers of barium stearate deposited on stainless steel, and therefore having a known thickness. The film is exposed for a short time to a source of radio-thorium, when thorium A (half-life 0·14 sec.) is deposited on the outermost layer of the film and decays immediately into thorium B. Some of the recoil atoms are ejected downwards

into the metal, the proportion actually reaching the metal being a function of n. This proportion is determined by comparing the β-ray activity of the specimen (measured with a Geiger counter) after dissolving off all the films in a suitable solvent, with the corresponding activity before dissolution. An absorption curve can then be obtained by varying n.

Method (2), which has been applied to thorium C, proceeds by trapping the atoms which recoil *outwards*: a deposit of thorium A obtained as in method (1) is 'blanketted' by covering with a number n' of barium stearate layers. Thorium B, formed by the decay of the thorium A, disintegrates into thorium C atoms, 35 per cent of which emit α-particles with the simultaneous production of recoil atoms of thorium C″. In the absence of blanket layers, a large fraction—nearly one half—of these recoil atoms are ejected out into the air and are lost. The blankets capture a fraction, dependent upon n', of these atoms recoiling outwards, thus raising the β-ray activity of the specimen (due to thorium C″) above its 'no-blanket' value. As the number of blanketting layers is progressively increased, the proportion of trapped recoil atoms, and consequently the β-ray activity, increases until it attains a saturation value corresponding to the capture of *all* the recoil atoms within the films. The value of n' at which this saturation value is just reached gives the desired recoil range.

Preliminary measurements show that the range of recoil atoms from thorium A is of the order of 60 layers of barium stearate—approximately 1500 A. or 2×10^{-5} gm./cm.²—and that the range of recoil atoms from thorium C is somewhat less than this. The values are 10–20 per cent lower than would be expected from previously measured ranges in air and silver, which give for thorium A $2{\cdot}2 \times 10^{-5}$ and $2{\cdot}5 \times 10^{-5}$ gm./cm.² respectively, but it must be borne in mind that the built-up films are oriented whereas the substances previously employed were isotropic.

We are now engaged on accurate determinations for the elements mentioned above, and in addition are adapting the technique to α-particle disintegrations in which the product recoil atom also emits an α-particle. The method should yield information concerning the passage of heavy charged particles through solids and should serve to elucidate the phenomenon of aggregate recoil.

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April 11.

J. Amer. Chem. Soc., **57**, 1007 (1935); *Phys. Rev.*, **51**, 964 (1937).

Mass and Mean Life-Time of the Meson

ACCORDING to the new field theory of nuclear forces and β-decay, the mesotron with the charge $-e$ (or $+e$) can transform into a negative (or a positive) electron and an antineutrino (or a neutrino) even in vacuum, the mean life-time of the former due to this process being proportional to the energy[1]. In previous papers[2], the proper life-time τ_0, that is, the mean life-time at rest, of the mesotron was calculated by assuming the interaction of it with the light particle, which was equivalent to that in Fermi's theory of β-decay. The result was

$$\frac{1}{\tau_0} = \frac{g'^2}{\hbar c} \cdot \frac{m_U c^2}{\hbar} \left(\frac{2}{3}\lambda_1^2 + \frac{1}{3}\mu_1^2 \right), \qquad (1)$$

where g' is a small constant with the dimension of the charge, m_U the proper mass of the mesotron and λ_1, μ_1 are dimensionless constants of the order of 1. Thus we obtained a value

$$\tau_0 = 1{\cdot}3 \times 10^{-7} \text{ sec.}, \qquad (2)$$

by taking $m_U = 200\,m$, $g' = 4 \times 10^{-17}$, $\lambda_1 = \mu_1 = 1$. Similar calculations were made for the case equivalent to the Konopinski-Uhlenbeck theory of β-decay, but the value of τ_0 thus obtained was smaller by a factor of the order $(m/m_U)^2$ than (1).

On the other hand, the proper life-time has been determined by several authors[4] from experiments on cosmic rays following the suggestion of Euler and Heisenberg[5]. Their results all point to a value

$$\tau_0 = 2 \sim 4 \times 10^{-6} \text{ sec.}, \qquad (3)$$

which is in qualitative agreement with the theoretical value (2) corresponding to the Fermi interaction, but is in contradiction with that corresponding to the Konopinski-Uhlenbeck interaction. On account of the importance of the problem, it is worth while considering the former case more closely.

According to Kemmer[6], we assume that the interaction between two heavy particles at a distance r in the S state is given approximately by

$$V_{12} = \vec{\tau}^{(1)}\,\vec{\tau}^{(2)} \left\{ \frac{1}{8} + \frac{5}{24}\left(\vec{\sigma}^{(1)}\,\vec{\sigma}^{(2)} \right) \right\} \frac{g^2 e^{-\varkappa r}}{r}, \qquad (4)$$

where $\varkappa = m_U c/\hbar$ and g is the constant with the dimension of the charge; $\vec{\sigma}^{(i)}$, $\vec{\tau}^{(i)}$ are spin vector and isotopic spin vector of the ith particle respectively. The numerical values of the constant

$$a = g^2 M/\hbar^2 \varkappa = (g^2/\hbar c)(M/m_U), \qquad (5)$$

which changes slowly with m_U, can be determined for several values of m_U by using the results of numerical solution of the deuteron wave equation with the potential of the form (4)[7], where M is the mass of the heavy particle.

Next, the constant g' is determined by comparing the mean life-time of the β-radioactive nucleus obtained in the previous paper[8] with the corresponding formula in Fermi's theory. The result is:

$$\frac{g'^2}{\hbar c} = \frac{\pi}{5} \frac{G^2}{a} \frac{M}{m} \left(\frac{m_U}{m} \right)^3, \qquad (6)$$

for case (i) $\lambda_1 = 0$, $\mu_1 = 1$;

and

$$\frac{g'^2}{\hbar c} = \frac{\pi}{2} \frac{G^2}{a} \frac{M}{m} \left(\frac{m_U}{m} \right)^3, \qquad (7)$$

for case (ii) $\lambda_1 = 1$, $\mu_1 = 0$;

where $G^2 = 0{\cdot}9 \times 10^{-4} \cdot \frac{\hbar}{mc^2} = 1{\cdot}2 \times 10^{-23}$

according to Bethe and Critchfield[9].

Hence, for case (i), (1) reduces to

$$\frac{1}{\tau_0} = \frac{\pi}{15} \frac{G^2}{a} \left(\frac{m_U}{m} \right)^4 \frac{mc^2}{\hbar}; \qquad (8)$$

and for case (ii) to

$$\frac{1}{\tau_0} = \frac{\pi}{3} \frac{G^2}{a} \left(\frac{m_U}{m} \right)^4 \frac{mc^2}{\hbar}. \qquad (9)$$

These expressions show that the proper life-time of the mesotron increases rapidly with decreasing mass m_U, the numerical values for several cases being summarized in the accompanying table.

	m_U	100 m	125 m	160 m	200 m
τ_0	Case (i)	10^{-6}	$0{\cdot}4\times10^{-6}$	$1{\cdot}2\times10^{-6}$	$0{\cdot}5\times10^{-7}$ sec.
	Case (ii)	$0{\cdot}2\times10^{-6}$	$0{\cdot}8\times10^{-6}$	$0{\cdot}2\times10^{-7}$	$0{\cdot}1\times10^{-7}$ sec.

Thus the theoretical life-time is always a little too short to account for the cosmic ray phenomena. However, the discrepancy between theory and experiment diminishes if we take a value of m_U nearer $100m$ than $200m$, and μ_1 large compared with λ_1 [10].

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Osaka.
March 9.

[1] Bhabha, NATURE, 141, 117 (1938).
[2] Yukawa, Sakata and Taketani, *Proc. Phys.-Math. Soc. Japan*, 20, 319 (1938). Yukawa, Sakata, Kobayasi and Taketani, *ibid.*, 993. The latter will be referred to as IV.
[3] IV, § 6.
[4] Blackett, *Phys. Rev.*, 54, 973 (1938); NATURE, 142, 992 (1938). Rossi, NATURE, 142, 993 (1938). Ehrenfest and Fréon, *C.R.*, 207, 853 (1938). Johnson and Pomerantz, *Phys. Rev.*, 55, 104 (1939). Clay, Jonker and Wiersma, *Physica*, 6, 174 (1939).
[5] Euler, *Naturwiss.*, 26, 382 (1938); *Z. Phys.*, 110, 450 (1938). Euler and Heisenberg, *Ergeb. exakt. Naturwiss.*, 17, 1 (1938). See also Ferretti, *Nuovo Cimento*, 15, 421 (1938).
[6] Kemmer, *Proc. Camb. Phil. Soc.*, 34, 354 (1938). See further, IV, § 2.
[7] Sachs and Goeppert-Mayer, *Phys. Rev.*, 53, 991 (1938). Wilson, *Proc. Camb. Phil. Soc.*, 34, 365 (1938).
[8] IV, § 5.
[9] Bethe and Critchfield, *Phys. Rev.*, 54, 248 (1938).
[10] According to Breit and Knipp (*Phys. Rev.*, 54, 652; 1938), the *K*-electron capture of ^{7}Be can be explained satisfactorily only if the condition $\lambda_1 < \mu_1$ is fulfilled. See further, Bethe and Critchfield, *loc. cit.*

Diffraction of a Current of Chemical Molecules

A CURRENT of particles of mass m and velocity v, that is, de Broglie wave-length,

$$\lambda = \frac{h}{mv},$$

will be scattered at incidence on a diffraction grating; in the case of a line grating and of a normal incidence, the scattering will take place in such directions δ_μ that

$$\sin\delta_\mu = \mu\frac{h}{mva},$$

a being the grating constant.

Two currents of particles having masses m and m', respectively, and the same velocity v, will be scattered in directions

$$\sin\delta_\mu = \mu\frac{h}{mva} \quad \text{or} \quad \sin\delta'_{\mu'} = \mu'\frac{h}{m'va}. \qquad (1)$$

Let us assume that the particles m and m' are combined in pairs. When the bond is a strong one, the scattering of the pairs will probably take place in accordance with the limit value formula

$$\sin\delta''_{\mu''} = \mu''\frac{h}{(m+m')va}. \qquad (2)$$

We do not know in what manner the passage from case (1) to case (2) is effected. Now if we consider that work can be produced at the diffraction process, and that with very weak bonds we have to do still with case (1) for reasons of continuity, we can presume that these weak bonds will be broken by the grating.

From this it seems evident that weak chemical bonds ought to be capable of being broken up by the process of diffraction.

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March 20.

Presence of Less Common Elements in Rocks

ONE of the latest patterns of the Hilger spectrometer has just been installed in the Chemistry Department of this College, and a systematic search for certain of the less common elements, more particularly the rare earths, in various rocks has been initiated. Incidentally, the spectral lines of nickel have been detected from dark green inclusions in various calcites, notably those from Cannington Park, near Bridgwater, and from Weston-super-Mare. The presence of the element was confirmed by the glyoxime test.

The Cannington Park calcite, given us by Mr. H. E. Balch, curator of the Wells Museum, proved particularly interesting. The nickel appeared to be present as carbonate, possibly as zaratite, along with copper carbonates, malachite and azurite. The characteristic spectral lines of vanadium were also detected and the existence of both elements confirmed chemically. Several other elements appear to be present also, and these we are endeavouring to confirm chemically.

The nickel in the Weston calcite was associated with silica, possibly as garnierite or genthite.

Incidentally, tellurium was similarly detected in the insoluble residue left after digesting sulphur from Krisuvik, Iceland, with carbon disulphide. Its presence was confirmed by reduction and recognition of its characteristic appearance under the microscope.

The problem of the distribution of the less common elements in our rocks and soils is one of great interest; when further data have been accumulated, it may well become one of extreme importance.

J. NEWTON FRIEND.
JOHN P. ALLCHIN.

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March 20.

'Intraglobular' Reaction in Protein Solutions

IN a letter[1] dealing with my hypothesis of 'intraglobular' reactions, Gralén and Svedberg state that the sedimentation constant of the product of the reaction of egg albumin with glycine ethyl ester measured by them remained practically the same as that of ordinary egg albumin, whereas the diffusion constant decreased to an extent corresponding to a 65 per cent increase of the volume of albumin globules. They believe that these results contradict the hypothesis of the existence of 'intraglobular' reactions.

Careful examination of Gralén and Svedberg's experimental results appears to me, however, to lend the best support to my hypothesis as well as to Wrinch's theory, although in my papers the necessary calculations have not been completed.

Without denying the fact that a portion of glycine ethyl ester must be bound to the surface of the albumin molecule (to test this point the adsorption on denaturated albumin at 0° C. was measured), it is necessary to establish that this reaction can take place only between glycine ester and free NH_2-groups of the basic amino-acids, constituting the albumin, with the formation of a new peptide bond. If this were otherwise, the cyclization reaction of glycine ester would lead to the formation of peptides along with 2-5-dioxopiperazine, which is not observed in reality. Saline bonds between an NH_2-group of glycine ester and free COOH groups of the albumin are excluded by the fact that they are very weak and are hydrolysed in the process of dialysis; such a hydrolysis has also not been observed.

According to data published by Bergmann and Niemann[2], the number of basic amino-acids (arginine, lisine and histidine) in a molecule of egg albumin amounts to 28, while the number of amino- and imino-groups in the side chains of these amino-acids is equal to 52. Hence it follows that out of the total number of glycine ester molecules which are bound with one molecule of egg albumin, only 52 are bound to the surface. This is, however, sufficient to create over the surface of the albumin globule a spherical shell with a thickness equal to the length of one glycine molecule, that is, *c.* 4·5 A., provided the glycine molecules are distributed symmetrically over the whole surface and are hydrated in the ordinary way. This corresponds to a 60 per cent increase of the volume of the globule, in excellent agreement with Gralén and Svedberg's measurements of the diffusion constant.

The invariability of the sedimentation constant is also explained very easily. If instead of determining the volume of the globule from the total volume of the albumin (as I did roughly initially), this volume is reduced, following Wrinch[3], by 40 per cent, assuming the thickness of the globules to be equal to 3 A., then the number of dioxopiperazine molecules that can be accommodated inside the globule will amount to 150 instead of 250. We have found that each albumin molecule is bound with 200 dioxopiperazine molecules. Since, however, 52 of them are bound to the surface of the globule, we find a good agreement in this case also. Owing to the fact that the density of dioxopiperazine differs very little from that of water supplanted by it, the sedimentation constant will remain the same, as has actually been observed by Gralén and Svedberg.

D. L. TALMUD.

Institute of Physical and
Chemical Researches,
Leningrad.
March 12.

[1] NATURE [143, 519 (1939)].
[2] *Science*, **86**, 187 (1937).
[3] *Phil. Mag.* (7), **25**, 709 (1938).

The Cyclol Theory and the Structure of Insulin

IT has been proposed that the insulin molecule has the C_2 cage structure. This structure fits the chemical and physico-chemical facts and those relating to cell molecular weight, space group and cell dimensions[1]. The view that this structure is inconsistent with certain experimental vector diagrams constructed afterwards has been advanced. Thus Crowfoot, for reasons nowhere stated, writes: "from the cyclol structure one would expect many more peaks in the Patterson synthesis than do actually occur"[2]. Alternatively, Bernal states that "the distribution of atoms in the cyclol skeleton is far too continuous to give rise to any definite peaks and no distribution of side chains can do other than increase the blurring of the picture"[3]. I can find no basis for either of these statements. The question of the vector map of the (C-C-N) units of the C_2 skeleton (the main features of which are readily appreciated by looking at very simple diagrams of certain idealized structures already published[4]) has been specifically raised by Bernal[5,6]. This map has now been constructed by Riley and Fankuchen[6], who use it to disprove two propositions, neither of which to my knowledge has been asserted, namely, (1) the insulin molecule consists of these 288 (C-C-N) units, and (2) these units and six points at the corners of a C_2 skeleton have the same vector map. This map cannot be regarded as a contribution to the study of insulin, since chemical requirements alone dispose of any idea that the insulin molecule has the composition $(C\text{-}C\text{-}N)_{288}$. However, the authors claim that it disproves also the hypothesis that insulin is a C_2 structure consisting of 288 ((C(OH)CHR)-N) units. To reach this result, they contend, following Bernal[3], that a decision regarding all C_2 structures (which exceed 10^{400} in number) can be reached on the basis of a vector projection of their (C-C-N)units (which in the case of insulin represent 28 per cent by weight of the crystal) no matter what these 288 *R* groups may be, no matter how they may be arranged, no matter what may be the composition or arrangement of atoms in intermolecular spaces. This contention, in view of the fact that vector maps are not additive, can scarcely be correct. The issue raised, namely, my claim regarding the relation between the C_2 structure and the particular vector projection of insulin which they discuss, remains unchanged. This claim runs "the 18 peaks per molecule are given in the correct positions, on the assumption that there are concentrations of atoms at the six slits"[7].

Apart from statements regarding uniqueness, dealt with in another place[8], the remaining criticisms of interpretations of the experimental vector diagrams in terms of C_2 structures[7,9] depend upon assuming definite intensities for groups of unknown chemical composition. Such intensities are necessarily arbitrary (cf. those given merely for purposes of illustration, but not made use of, in one of these investigations[9]). Crude maps based upon arbitrary intensities do not permit the assertion that the cyclol model leads to results incompatible with the X-ray evidence. On the contrary, C_2 not only fits all the deductions from this evidence the reliability of which has not been questioned[10], but also it has provided the first hint as to a possible interpretation of the vector diagrams, previously left uninterpreted[3], a hint which Bernal appears to have made use of in the 18-point model for insulin which he has since proposed[11]. (This model has already been adversely criticized[8,12].) For with the C_2 structure in mind, it was seen[7,9,13] that certain outstanding features of the diagrams can be interpreted in terms of the system of electron density deviations, $3s + 3s' - o$, namely, six regions of high electron density at the corners of an octahedron of side 29–30 A. and a low density region at its centre. Now it so happens that C_2 is a fabric cage with six special regions or slits which lie

approximately at the corners of an octahedron, and that this octahedron is of side $8\sqrt{6}a = 29{\cdot}4$ A. Thus "on the assumption that there are concentrations of atoms at the six slits"[7], presumably belonging to special R groups or water of crystallization, the C_2 structure, which necessarily has a low density region in its interior, gives a simple and unforced interpretation of certain features of the vector diagrams.

The investigations under discussion—and equally criticisms of them—have proceeded on the assumption that the experimental vector diagrams give a true representation of the situation in the insulin crystal. But it must be remembered that, quite apart from any lack of accuracy in the observations, the fact that the number of observations is incomplete means that the actual vector map prepared from them is necessarily a very distorted version of the true one. Further, in this particular case, the supply of data (59 relative measurements of amplitude) is certainly very meagre. Indeed the opinion has been expressed that "they are so inadequate that it is hardly worth while trying to make any kind of detailed analysis from the intensity data at present"[14]. In these circumstances, it is necessary to await more extensive data. Meanwhile, it may perhaps be wiser to limit deductions from the present X-ray data to the space group, the cell molecular weight and the dimensions of the unit cell. With these data, as with the general chemical and physico-chemical data, the C_2 structure (as was shown at the outset[1]) is in good accord.

DOROTHY WRINCH.

New York.

[1] Wrinch, *Science*, **85**, 568 (1937): *Trans. Faraday Soc.*, **33**, 1368 (1937).
[2] Crowfoot, *Proc. Roy. Soc.*, A, **164**, 580 (1938).
[3] Bernal, NATURE, **143**, 75 (1939).
[4] *Phil. Mag.*, **27**, 98 (Jan. 1939).
[5] Physical Society, Dec. 20, 1938.
[6] Riley and Fankuchen, NATURE, **143**, 648 (1939).
[7] Wrinch, *J. Amer. Chem. Soc.*, **60**, 2005 (1938).
[8] Langmuir and Wrinch, *Proc. Phys. Soc.* (forthcoming).
[9] Wrinch and Langmuir, *J. Amer. Chem. Soc.*, **60**, 2247 (1938).
[10] Robertson, NATURE, **143**, 74 (1939).
[11] *Proc. Roy. Soc.* B, **127**, 36 (1939).
[12] Langmuir, Physical Society, Dec. 20, 1938 (in course of publication).
[13] Wrinch, NATURE, **142**, 956 (1938).
[14] Robertson, Physical Society, Dec. 20, 1938.

History of the "Widmanstätten" Structure

MY attention was recently directed by Dr. R. T. Gunther to a paper by G. Thomson (= W. Thomson, F.R.S.)[1], which appears to have been generally overlooked, describing the Krasnojarsk meteorite, a pallasite containing abundant nickel-iron with about 10 per cent of nickel.

The particular interest of this paper, which is dated February 6, 1804, and published in the *Atti Accad. Sci. Siena*, **9**, 37 (1808), lies in the fact that Thomson studied the action of dilute nitric acid on the nickel-iron; the resulting etch figures are fully described and figured, and it is clear that Thomson anticipated the work of von Widmanstetter (or Widmanstätten), which was carried out in 1808 and published in 1812.

MAX H. HEY.

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March 29.

[1] [See also NATURE of April 22, p. 667].

Active Form of Vitamin B_1 in Tissues

THOUGH there has been a strong indication since the work of Lohmann and Schuster[1] that the active form of vitamin B_1 in pigeon brain tissue is phosphorylated, the failure to obtain much activity with cocarboxylase in the catatorulin test with 'brei' or slices has made it impossible to make a firm decision[2,3]. We are now able to report that with the use of two types of finely ground 'avitaminous' brain preparations (in presence of fumarate) we can get either (1) a preparation which shows good catatorulin effects with small amounts of cocarboxylase (0·26 γ max.) and practically no effect with vitamin B_1, or (2) one which still retains some catatorulin effect with large amounts of vitamin B_1 (10 γ) as well as good effects with small amounts of cocarboxylase. Both preparations are rather unstable; the medium used is as in previous experiments.

As there can be little doubt that these ground preparations permit of better access to active centres, and as synthesis of cocarboxylase can be found when vitamin B_1 is added to preparation (2), we consider it to be now proved that the active form of vitamin B_1 in brain is phosphorylated; the failure in the ordinary catatorulin test (as was previously suggested)[2] is due to impermeability of the brei to cocarboxylase, the effect of vitamin B_1 being produced after phosphorylation.

Full details will be presented elsewhere.

I. BANGA.
S. OCHOA.
R. A. PETERS.

Department of Biochemistry,
Oxford.
April 1.

[1] Lohmann and Schuster, *Biochem. Z.*, **294**, 188 (1937).
[2] Peters, *Biochem. J.*, **31**, 2240 (1937).
[3] Ochoa and Peters, *Biochem. J.*, **32**, 1501 (1938).

Growth Activation of Cell Colonies *in vitro* by Extracts of Adult Tissues

AN extensive growth of cell colonies *in vitro* is only obtained if tissue extracts are added to the culture medium. It has been generally accepted (Levi[1], Verne[2], Willmer[3]) that extracts of growing tissues (embryonic and neoplastic tissues) and extracts of organs with active cell formation (for example, bone-marrow) chiefly possess these growth-activating properties. Extract of embryonic tissue is considered to be the best growth activator (Willmer[3]).

Experiments were undertaken to determine whether the property of cell-growth activation is especially characteristic of proliferating tissue as opposed to mitotically inactive, stable tissue.

We investigated the growth-promoting effect of aqueous extracts from various tissues of adult chickens and compared the action of these extracts to each other as well as to extracts of seven-day-old chick embryos.

The stimulating effects of tissue extracts were quantitatively tested on fibroblast colonies in Carrel flasks, prepared according to the standard technique. The growth of cell colonies was observed and measured over a period of seven days. During this time the added tissue extracts were not renewed.

Our experiments proved that extracts of tissues of adult animals including mitotically inactive tissues, markedly increase the rate of growth of cell cultures.

Extracts from heart, smooth muscle, striated muscle, brain, lung, liver, kidney, testes, ovary, oviduct, and pancreas proved to be very active. Extracts of spleen and bone-marrow are effective, but not more so than extracts of other tissues. Liver, and to a less extent kidney, differ somewhat in their growth-promoting action from other organs. Extracts from these two organs show a marked initial stimulation followed after three days by a slowing down of the rate of growth and degeneration of the cells resulting in a complete stoppage of growth by the fourth to sixth day.

The growth-promoting action of all extracts used (with the exception of liver and kidney extracts) varies somewhat within relatively small limits and is extremely pronounced. A comparison of the cell growth activating effects of adult tissue extracts with those of embryonic extract of the same concentration shows that under our experimental conditions the growth-promoting properties of extracts of adult tissues are definitely greater than those of embryonic tissues. Extracts of brain and heart, for example, increase the growth rates of fibroblasts two to three times as much as embryonic extract.

It can be concluded that the ability to stimulate growth of cell colonies *in vitro* is not a specific property of extracts of proliferating tissues, but that growth-stimulating substances are found in abundance in most animal tissues and organs.

We wish to mention here that our work confirms the earlier, much overlooked experiments of Carrel[4] and Walton[5] who already in the years 1913 and 1914 indicated that extracts of certain adult tissues stimulate cell growth somewhat.

Details of our experiments are being published elsewhere.

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E. TENENBAUM.
L. DOLJANSKI.

Department of Experimental Pathology,
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March 24.

[1] *Erg. Anat.*, **31**, 125 (1934).
[2] "La Vie cellulaire hors de l'organisme" (Doin and Cie., Paris, 1937).
[3] "Tissue Culture" (Methuen and Co., London, 1935).
[4] *J. Exp. Med.*, **17**, 14 (1913).
[5] *J. Exp. Med.*, **20**, 554 (1914).

Pasteur Reaction in the Lactic Acid Bacteria

THE lactic acid bacteria show three well-defined types of Pasteur reaction which can be correlated with the respiratory mechanisms of the three main groups into which these bacteria (cocci and rod forms) can be classified.

	Group I	Group II	Group III
Catalase	0	0	0
Respiration	0	+	+
Cyanide inhibition	−	0	+
Hydrogen peroxide formation	−	+	0
Methylene blue stimulation	+	+	0
Glycolysis aerobic	+++	++	+++
" anaerobic	+++	+++	+

The experiments were made in the Barcroft-Warburg apparatus.

Organisms in Group I cannot use molecular oxygen to oxidize sugars, etc.[1], although 'protoplasmic respiration' (autoxidation) can be detected. There is correspondingly no Pasteur effect. Lactic and pyruvic acid dehydrogenases are present in organisms of Group II[2] and an appreciable Pasteur effect is noticeable.

Group III (heterofermentative) types are peculiar in that apparently a negative Pasteur effect is present. This group grows almost equally well anaerobically and aerobically, so that its respiratory mechanism would not appear to be a very efficient means of obtaining energy for growth. Considerable amounts of acetic acid are produced aerobically, but in addition more lactic acid (estimated chemically) is produced aerobically than anaerobically. This is believed to be a very rare, if not a unique, phenomenon.

These findings form the basis of a classification which will be published shortly.

J. G. DAVIS.

National Institute for
Research in Dairying,
University of Reading.
April 4.

[1] Davis, *Biochem. Z.*, **267**, 357 (1933).
[2] Davis, *Biochem. Z.*, **285**, 90 (1933).

Mauicetus: a Fossil Whale

IN 1937, I published in the *Transactions of the Royal Society of New Zealand* an account of a portion of a skull of an extinct whale found in the Upper Oligocene of New Zealand. To this skull I gave the generic name of *Lophocephalus*. Soon after the appearance of the article, my attention was directed to the fact that this same title had been bestowed already on three animals of widely different groups, namely, on a gregarine, on a beetle and on a fish; hence it is necessary to substitute another generic name for this whale. I propose to use the name *Mauicetus*. This name definitely associates the whale with New Zealand, for the Maoris have many legends about that mythical demi-god Maui.

W. B. BENHAM.

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March 13.

Ancient Egyptian Astronomy

IN a recent communication to NATURE[1], Dr. H. Chatley points out that in my former communication[2] I did not take account of a whole group of important papers of well-known scholars, and he adds some remarks on stars and planets in ancient Egypt. I think Dr. Chatley must have overlooked my first sentence, where I speak on "Egyptian *calculating* astronomy". We were, in fact, speaking on entirely different problems.

Dr. Chatley even makes statements concerning the historical estimation of the Egyptian "theoretical" astronomy (*sit venia verbo*). I want to take up this problem, for it seems to me of importance to prevent misstatements taking up a firm position also in this field from the very beginning. Dr. Chatley says: "It seems very doubtful if one can safely attribute much mathematical ability to the ancient Egyptians on the basis of the demotic texts to which Dr. Neugebauer refers. From the time of the foundation of the Museum at Alexandria, Greek methods appear to have been adopted." I do not know who attributed to the ancient Egyptians in this connexion "much

mathematical ability". In the letter of mine this statement is not made and in the paper quoted there on p. 116, note 1, concerning the Egyptian calculation of the new moons, I did say explicitly (p. 403): "Compared with the methods of the Babylonians and Greeks, this method here is very simple and shows no consideration of the anomalies of the motion of the moon and the sun, very carefully studied both by the Babylonian and Greek astronomers". It seems to me, indeed, to be the most important result of the discovery of an Egyptian "theoretical" astronomy, that it represents a state of development just as "primitive" as the Egyptian mathematics. Even the fact that those texts to which I was referring belong to the Roman period and for all that do not at all show the least influence of Greek methods, seems to me of the highest interest. This makes an exact parallel to an analogous position in mathematics, where the Egyptian mathematics, too, retains its primitive character, quite uninfluenced by the Babylonians and by the Greeks. The striking recent investigation of Cumont on Egyptian astrology[3] in this field proves also the splendid isolation of the work of the Egyptian astrologers from the world of their Greek masters—a fact evidently overlooked by Dr. Chatley, else he would not speak so securely of a "purely Greek astrology".

I can also only repeat the conclusion of my preceding letter, that now it is possible for the first time to make a complete comparison of Egyptian, Babylonian, and Greek astronomy, as was possible in the history of mathematics a little earlier.

O. NEUGEBAUER.

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Providence, Rhode Island.

[1] NATURE, 141, 336 (1939).
[2] NATURE, 143, 115 (1939).
[3] Cumont, F., "L'Egypte des Astrologues" (Bruxelles, 1937).

Points from Foregoing Letters

THE emission of gamma-rays of six million electron-volts energy when fluorine (mass 19) is bombarded with protons, may be explained, according to P. I. Dee, S. C. Curran and J. E. Strothers, by the formation of excited oxygen nuclei (mass 16). Excited neon nuclei (mass 20) are first formed, and these give up alpha-particles of low energy, thus changing into oxygen nuclei.

Experiments by J. L. Michiels, G. Parry and G. P. Thomson on the production of neutrons as a result of the fission of the uranium nucleus show that the processes of fission by fast and possibly by slow neutrons lead to a net gain in the number of neutrons.

E. E. Widdowson and S. J. Gregg have developed methods for obtaining the absorption curves and ranges of the recoil atoms from certain α-particle disintegrations, using built-up films of barium stearate to provide sufficiently thin absorbing screens.

The mean life-time of the meson due to spontaneous disintegration, according to H. Yukawa and S. Sakata, depends critically on its mass, and the discrepancy between theory and experiment becomes smaller as the mass decreases, although the theoretical life-time is always smaller than the experimental value $2 \sim \frac{1}{2} \times 10^{-6}$ sec.

From considerations of the work which can be produced when a current of molecules is scattered at incidence on a diffraction grating, W. Krejczy concludes that weak chemical bonds may be broken by the process of diffraction.

Spectroscopic analysis of various limestones and other rocks is being systematically undertaken in the Chemistry Department of the Central Technical College, Birmingham. Mention is made by J. Newton Friend and J. P. Allchin of the presence of nickel and vanadium in calcites from Cannington Park near Bridgwater and from Weston-super-Mare. Tellurium was found in sulphur from Krisuvik, Iceland.

D. L. Talmud re-interprets the findings of Gralén and Svedberg on the sedimentation constant of the product of egg albumin with glycine ethyl ester, and states that the experimental data do not disprove, but rather support, the hypothesis of intraglobular protein reaction based upon Wrinch's cyclol model for proteins.

D. M. Wrinch discusses objections to the C_4 cage structure for insulin, which were brought forward on the strength of 'vector maps', and states that no reliance can be placed upon such vector maps because the number of observations used in their preparation is incomplete.

Max H. Hey points out that a paper by W. Thomson, hitherto generally overlooked, shows that Thomson anticipated Widmanstätten's discovery of the etch-figures on meteoritic iron by some years.

I. Banga, S. Ochoa and R. A. Peters state that they have now obtained preparations from avitaminous pigeon brain which show either catatorulin effects with cocarboxylase and not with free vitamin B_1 or with both. The catatorulin effect is the name given to the oxygen uptake induced in avitaminous brain brei by vitamin B_1 addition. They consider it to be proved that the active form of vitamin B_1 in brain tissue is phosphorylated.

The aqueous extracts of the many adult tissues and organs investigated by R. S. Hoffman, E. Tenenbaum and L. Doljanski are said to stimulate growth of fibroblast colonies *in vitro* to a high degree. Under their experimental conditions, the stimulating action of these extracts was in most cases greater than that of embryonic extract. It was concluded that the ability to stimulate growth of cells *in vitro* is, therefore, not a specific property of extracts of proliferating tissues, but that growth-stimulating substances are found in abundance in most animal tissues and organs.

Working on the metabolism of the lactic acid bacteria J. G. Davis has found that the three main groups into which these bacteria can be classified according to respiration mechanisms show correspondingly three different types of Pasteur reaction. Group III (heterofermentative) shows an apparently negative Pasteur effect.

Research Items

British Decorated Axes in the Early Bronze Age

A STUDY of the diffusion of British decorated axes of the Early Bronze Age by B. R. S. Megaw and Miss E. M. Hardy (*Proc. Prehist. Soc.*, N.S., **4**, Pt. 2; 1939) indicates the importance of these axes in the material culture of the British and Irish Bronze Age and that of western and northern Europe. Fundamentally there are only two types: Type I, without flanges, ranging from 6 to 12 inches in length; and Type III, with strong cast flanges, normally from 4 to 6 inches in length. Type II, though in size following Type I, has straighter sides, and low flanges are present. The ornament is wholly geometrical in character. Ornamented axes have been found only in the British Isles, south Scandinavia, Saxony, France and Holland. The greatest number occurs in the British Isles, being concentrated in north-east Ireland, east Scotland, Yorkshire, the East Anglian Fens and the valleys of the Boyne, the Laggan and the Thames, all districts favourable to early settlement. Type I occurs most frequently in Ireland, Type III—though there is a considerable number in Ireland—concentrates in south-east England. Distributional study suggests the possibility that metal-working in the north and west may have started in the west and, carrying Type I, spread from Ireland and the 'highland zone' of Britain to the Continent, reaching Scandinavia via the Moray Firth, rather than via Caithness; while local development suggests the possibility that Irish craftsmen have settled in the Baltic. It is possible, or even probable that Type III originated on the Continent in northern Italy or Bohemia, whence it reached Scandinavia and Southern Britain and ultimately Ireland. This diffusional development illustrates the thoroughly cosmopolitan character of the Early Bronze Age, while a comparison of the character of the ornament with that of the schist plaques from Portuguese passage graves strengthens the attribution of an Iberian origin to Irish metallurgy. The practice of decorating the axe may derive from the spread of the cult of the sacred axe to the west and north.

Gold Pendant from Ancient Columbia

A GOLD object of unusual size and importance has been presented to the collections of the Ethnographical Department of the British Museum (Bloomsbury) by the National Art-Collections Fund. It is a pendant of ancient Colombian provenance in the form of a ceremonial knife with curved edge, similar in form to ancient copper knives from Peru and Ecuador; but the place of the handle is occupied by a highly conventionalized human figure, wearing an elaborate headdress with open-work geometric ornament. H. J. Braunholtz, who has figured and described the pendant (*Brit. Mus. Quarterly*, **13**, 1, 1939), cites a parallel from gold objects of the Chimu period found in the Lambayeque Province of northern Peru in 1936. In the present example the headdress is flanked by smaller beaked figures, repeated below, while to the arms are attached animals resembling monkeys with birds' heads. The central figure wears a large circular nose-pendant and three bead necklaces. The legs are constricted below the knee with tight bands, a feature found in ancient Columbian figure vases. Similar bands are still to be seen worn by living South American tribes. A peculiar character in the figure is the large number of fingers (fifteen on each hand) and toes (thirteen and fourteen). In general aspect the figure is unique, but it presents Peruvian and Panamanian affinity—additional evidence of the strong cultural connexions between north and south indicated in the Chimu period, if not earlier. Its date probably falls between A.D. 1000 and 1400. A record in ink on the specimen indicates its place of discovery as Popayan in the Cauca River valley. This is south of the area of the Qimbaya culture, which produced some of the finest gold work of pre-Columbian America. Though the entire surface is covered with gold, this is superficial only, and encloses a core of base metal with a specific gravity of 9·7, indicating a silver-copper alloy in equal parts. The method by which the pure gold was applied cannot be determined without minute microscopic analysis; but probably it was a form of amalgam plating.

Blood Groups in Man

PROF. R. RUGGLES GATES (*Z. Rassenkunde*, **9**, 58; 1939) summarizes the data on the distribution of blood-groups *A* and *B* among the races of man. Blood group *A* is found in the chimpanzee and gorilla and in primitive races of man, but blood group *B* is not found in these relatives of man and to a very small extent in the primitive races. Since the proportions of *A* and *B* vary greatly in different races occupying similar environments, it is suggested that mutation, not selection, is the cause of the different distributions. Blood group *B* probably has arisen by mutation after the evolution of man, whereas *A* may have been derived from the early ancestors. As in plants and animals, parallel mutations at different mutation rates in different races may occur in man.

Sulphanilamide in Experimental Brucellosis

B. D. CHINN (*J. Infect. Dis.*, **64**, 78; 1939) carried out experiments *in vitro* showing that sulphanilamide has a bactericidal and bacteriostatic effect on *Br. melitensis*, *Br. abortus* and *Br. suis*. He also found that the drug had a protective action in 100 per cent of guinea pigs inoculated with these organisms when treatment was started immediately after inoculation. Sulphanilamide had also a definite therapeutic effect in guinea pigs infected with *Brucella* when treatment was begun a week after inoculation. 50–100 per cent of the animals, according to the type of organisms injected, were negative pathologically and culturally after treatment, while untreated animals were all positive for *Brucella* and showed characteristic lesions. Infections in guinea pigs due to *Br. abortus* and *Br. suis* responded more satisfactorily to sulphanilamide than did *Br. melitensis* infections.

Anaphylaxis in the Rhesus Monkey

L. M. Kopeloff and N. Kopeloff (*J. Immunol.*, **36**, 83; 1939) demonstrated the following anaphylactic phenomena in the rhesus monkey after intravenous

injection of horse serum: severe and fatal shock, Arthus reactions, and functional and pathological changes, including delay in clotting time of the blood, reduction in the number of blood platelets, emphysema, œdema and hæmorrhage of the lungs, œdema and hæmorrhage of the intestinal tract, and occasional hæmorrhage in other internal organs. Precipitins to horse serum were present after repeated injections. No correlation was found between the titre of the serum and the degree of sensitivity as measured by shock. The authors (*ibid.*, **36**, 101; 1939) also produced severe and fatal anaphylaxis in monkeys by intravenous injections of egg-white. Repeated injections proved more effective for sensitization than single injections. Fatal anaphylaxis usually occurred within six minutes of the injection of egg-white, and was usually preceded by respiratory difficulty, unconsciousness and collapse. Post mortem, occasional emphysema of the lungs with petechial hæmorrhages was found. After shock the blood platelets were reduced to about a third or less of their original number and the coagulation time was appreciably delayed.

Adaptation of a Black Sea Fish to Changes of Salinity

THE Black Sea is inhabited by *Atherina pontica eichwaldi*, a teleostean fish, which is probably a descendant of the Mediterranean species *A. hepsetus*. If this phylogeny is correct, the Black Sea species already shows adaptation to very special conditions, for the average salinity there is only 18 per cent, and it is subject to sudden and serious changes, whereas the salinity of the Mediterranean remains steadily about 35 per cent. Eugen A. Pora has made tests to determine the limits of the adaptability of *A. pontica* to saline conditions (*Ann. Sci. Univ. Jassy*, **24**, 319; 1938). He finds that it cannot survive in the salinity of the Mediterranean, its presumed original habitat, but is limited to a range from 12 to 20 per cent. In low salinities the smaller individuals die more quickly than the larger, in high salinities the order is reversed; and in both cases the incidence of death seems to depend upon the size of the gills in relation to body size. The smaller individuals have a large branchial area in relation to the body, the larger individuals have a relatively smaller branchial area; the former die more rapidly in low salinities from a loss of body salts, the latter die more rapidly in high salinities on account of histological changes in the gill filaments which bring about asphyxiation.

A New Mysid Crustacean from the Black Sea

AT present only three species of *Hemimysis* are known from European waters: the deep-water *H. abyssicola* from Norwegian fjords, *H. lamornæ*, a widely distributed littoral form ranging from north-west Europe to the Mediterranean and Black Seas, and the adaptable *H. anomala* confined to the Caspian and Black Seas, but penetrating even to the fresh waters of the latter basin. To that short series Mihai Băcesco adds a fourth species from the Black Sea (*Ann. Sci. Univ. Jassy*, **24**, 425; 1938). It is a beautiful species with many chromatophores, brilliant red with yellow or orange markings, and the rapidity of colour change from full colour to almost clear transparency is remarkable, even under the local environmental change caused by agitating the water of the aquarium. The discovery of this new species, *H. serrata*, raised the number of forms recognized from the Black Sea to three, out of a known total of four, and the author makes the suggestion that the Black Sea basin, or more generally the Ponto-Caspian region, may be the evolutionary cradle for the genus *Hemimysis*, as it is for the rich genus *Paramysis* and perhaps also for *Diamysis*. It cannot yet be safely said that the new species is endemic to the Black Sea for the mysid fauna of the eastern Mediterranean has been little studied and upon such study must await the determination of the relationship of the forms occurring in the closed waters of eastern Europe.

Plant Behaviour

THE Masters Lectures of the Royal Horticultural Society for 1938 were given by F. J. Chittenden, who chose "The Behaviour of Plants" for the title of his discourses (*J. Roy. Hort. Soc.*, **64**, Pts. 2 and 3, February and March 1939). His first lecture dealt mainly with periodicity of development of garden plants. Shortening the normal period of dormancy of plant shoots can be accomplished in several ways. Mr. Chittenden reviewed the various methods with a combination of historical background, practical outlook and scientific exactitude, which is not often accomplished. He furthermore mentioned the simple expedient of plunging the dormant plant in a bath of warm water, a method of breaking the rest period which seems to have been forgotten of recent years. Dutch work upon periodicity of the common bulbs was marshalled in such a way that many suggestive points of view emerge from the text. There are, however, many plants which could better represent the conception of 'short-day' flowering plants than the lecturer's choice of *Dahlia*, though his descriptions of earlier flowering in London than in New York, are none the less interesting. The second lecture was chiefly devoted to a consideration of plant hardiness. The maidenhair tree, *Ginkgo biloba*, was cited as one of the hardiest plants under wide extremes of climate, both recent and geological. *Primula nivalis*, on the other hand, has evidently such a narrow range of hardiness that it is extremely difficult of cultivation. Damage by early frosts in such southern plants as *Amaryllis Belladonna* is regarded as incomplete acclimatization in the northern hemisphere, but several interesting examples are given of quick adaptation to the reversal of climatic sequence involved in transplantation from north to south or vice versa. Many plants, as *Primula malacoides*, are also more variable in cultivation than they were in the wild state, whilst others are not. Generalizations are not possible between plant species; each one has its own innate characteristics, which must form the subject of separate experiments before adequate horticultural control can be expected.

Colchicine and Wheat Hybrids

E. R. SEARS (*J. Hered.*, **30**, 38; 1939) describes the production of fertile polyploid generic hybrids by the aid of colchicine. The seeds resulting from the crosses *Triticum monococcum* × *Aegilops uniaristata*, *Ae. caudata* × *Ae. umbellulata* and *Ae. speltoides* × *Ae. umbellulata* were immersed in a solution of colchicine for twenty-four hours. As much as one third of some of the mature plants were found to be tetraploid $2n = 28$ and fertile, whereas the remainder of the plants was diploid and sterile.

Sex Chromosomes of *Cricetus auratus*

THE small rodent, the golden hamster, has an *XY* pair of chromosomes of equal size during mitosis but greatly differing in construction and appearance during meiosis (P. C. Koller, *J. Gen.*, **36**, 177; 1938). This arises from the fact that the differential part of the *X*-chromosome remains during meiosis in a similar extended state to that of mitosis while the pairing segments of the *X*- and the *Y*-chromosomes are normally condensed. The centromere is localized in the pairing segments and chiasmata may be formed on either side of it. It is therefore to be expected that a number of characters may be controlled by genes on the sex chromosomes but may not show sex linkage. The differential segment of the *X*-chromosome shows 81·6 per cent pre-reductional segregation.

Effect of Pressure on the Rigidity of Rocks

THIS was the subject of a considerable amount of experimental work by Francis Birch and Dennison Bancroft of Harvard University (*J. Geol.*, **46**, Nos. 1 and 2; 1938). They employed a method whereby a right circular cylinder of the specimen about 20 cm. long and 2 cm. in diameter was set into forced torsional oscillation by means of a driving armature at one end, and the resulting motion observed by another armature at the other end leading to an A.C. voltmeter. The whole was subjected to pressures of nitrogen gas varying between 1 and 4,000 kgm./cm^2. by placing it in a thick-walled steel tube. Using a water jacket, temperatures were varied between 30° C. and 100° C. Very large changes in rigidity were observed in many cases upon the application of the first few hundred atmospheres, but at high pressures the change of rigidity with pressure became nearly linear and small. Extrapolating from the results obtained, the authors discussed the materials and temperature conditions in the surface layers of the earth. The usually accepted values of the velocities of *P* and *S* waves in the granitic layer they suggested as being those in a granite with a low quartz content. For the intermediate layer they considered that their results were not inconsistent with some diabasic or gabbroic rock. In view of their small coefficients of increase of rigidity with pressure and temperature, however, they found great difficulty in fitting in any of their rock types with the normal velocities of 7·8 km./sec. and 4·35 km./sec. respectively for the *P* and *S* waves in the underlying supposedly basic material.

Viscosities of Liquid Helium

SOME very puzzling results have been obtained for the viscosities of liquid helium. Some observers found a normal increase with decrease in temperature from 4·2° to 2·2° K. but below 2·2° K. the viscosity decreased rapidly. It has also been considered that at lower temperatures the viscosity fell below an experimentally determinable value. The suggestion has been made that a film is formed on a tube surface in which liquid helium is being evaporated under reduced pressure. W. F. Giauque, J. W. Stout and R. E. Barieau (*J. Amer. Chem. Soc.*, **61**, 654; 1939) now describe some experiments which are very satisfactorily explained by the transfer of helium up the walls of the tube. Their own experiments indicate that the viscosity of liquid helium decreases from $2{\cdot}0 \times 10^{-3}$ poise at 2·266° K. to $1{\cdot}0 \times 10^{-7}$ poise at 1·468° K. The largest Reynolds number, which occurred at 1·468° K., was estimated to be about 200, instead of very much larger values formerly reported. At the lowest temperature of measurement the viscosity was found to be still decreasing rapidly, and it appeared to be approaching zero at the absolute zero of temperature.

Theory of Air-Conditioning Systems

AN instructive paper, by R. O'Neill Hobson, has recently reviewed the fundamental theory governing the operation of air-conditioning systems (*British Engineers' Export Journal*, April). These systems consist in the treatment, modification and control of all the physical and some of the chemical properties of air. They also involve the simultaneous control of temperature and humidity, purity and movement of the atmosphere within enclosed spaces. The demand in each industry varies from that of others over a wide range. The processing of cotton and artificial silk, for example, which requires a humidity point of at least 80 per cent, contrasts sharply with the manufacture of chocolates, where the maximum humidity should not exceed 25 per cent, or of match production, which needs no humidity at all. In the same way the temperature demands vary considerably. In a country where there is often a wide degree of temperature variation from dawn to dusk, as well as from day to day, ideal conditions can only be secured by a well-designed and efficient system. In those systems where both the temperature and the moisture content have to conform to set standards, the apparatus must be designed to duplicate as nearly as possible the changes which Nature makes on a large scale. Heat must be supplied to evaporate water, and heat must in turn be subtracted to effect the condensation of water vapour. It is essential to have the operation of the plant automatically controlled. Humidity control is of equal and sometimes of greater importance than temperature control. The large-scale air-conditioning and refrigeration installed in many South African gold mines enable gold companies to explore much greater depths.

Measurement of Radio Fields at Ultra-Short Waves

THE general development of the ultra-short band of wave-lengths below 10 m. for television broadcasting and for radio-telephone links, has given rise to a demand for accurate methods of measuring field intensity on these wave-lengths. The March issue of the *Journal of the Institution of Electrical Engineers* contains a paper by F. M. Colebrook and A. C. Gordon-Smith describing the design and construction of a measuring set developed at the National Physical Laboratory for wave-lengths of 7–11 m. (frequencies 27 to 43 Mc./s.) The apparatus consists of a high-gain intermediate-frequency amplifier (about 1 Mc./s.) associated with a signal-frequency and frequency-change unit of constant conversion efficiency. The E.M.F. of thermal agitation in the input tuned circuit of the intermediate-frequency amplifier is used as a standard signal for setting the amplifier to a known amplification. The whole apparatus is calibrated over its signal-frequency range by means of a small transmitter which gives a horizontally polarized radiation of calculable intensity. A loop aerial system is employed, coupled inductively through a suitable electric screen to the frequency-change circuit. The apparatus is suitable for measuring field intensities of any value down to about 1 microvolt per metre.

Location of Industry in Great Britain*

THE report on the location of industry which has now been issued by Political and Economic Planning (P E P) is one of a series of contributions to this subject which has been made by P E P since, in April 1935, it was decided to undertake a comprehensive study of regional development to provide a sound basis for the evolution of policy. Apart altogether from its recommendations, this report contains much that is new and gives by far the most comprehensive and scientific survey yet available of a problem which many factors besides those of the Special Areas and defence policy are forcing upon our attention.

After reviewing briefly the factors which led to the emergence of the problem, the report, by means of a series of diagrams, shows the recent changes in British industry and its present distribution by regions. The employment chart for all insured persons, including distributive and other workers, shows how, between 1923 and 1937, the south-east, Greater London, the south-west and the Midlands increased their proportion of total national employment at the expense of other regions, particularly Wales and the North. Since 1921, some 700,000 persons from other parts of Great Britain have migrated to Greater London. The net output figures show similar changes, with Greater London rising by nearly 50 per cent between 1924 and 1935 and South Wales declining almost as sharply. In 1935, Greater London had more workers actually employed than any other region, and at the same time a higher value of net output per head. Apart from their heavier burden of unemployment, the older industrial regions of the north-east, the West Riding and Lancashire have markedly lower net outputs per head than the south-east and east England or the Midlands. Between 1927 and 1937, the extractive group of industries reduced its use of labour by more than 30 per cent, textiles and clothing by 20 per cent, while heavy industry also slightly declined, but light and intermediate industries, building, transport, distribution and services expanded their personnel.

The region with fewest types of industry is south Scotland, in which 39 per cent of British industries are virtually unrepresented and a further 36 per cent have location factors below 0·45. Lancashire and Cheshire show most types of industry, while the West Midlands have the largest share of industrial concentration, nearly 20 per cent of their industries having location factors greater than 2. Between 1924 and 1935, Greater London maintained or increased its relative share of output in all industrial groups except two, and even in these its net output increased. Nevertheless, London is now getting no more than its proportionate share of new employment. In the last six years, the south-east and Midland divisions have made most advance, but the northern division has recovered nearly a third of the ground previously lost. Scotland, Wales and the north-east have held their own, the north-west continuing to lose heavily. The four southern divisions now claim nearly 54 per cent of British employed workers as against less than 47 per cent in 1923, and London's employed population is now nearly half as high again as sixteen years ago.

Changes in employment in individual industries are also discussed, and the report then considers the factors which have determined the location of industries, including some discussion of the finance of new developments. A close survey of existing trading estates follows, while an analysis of the effects of the location of industry points out that about 43,000 acres of land are taken from the farmer annually by industry, while at the same time the State has to spend large sums on cleaning up sites abandoned by industry in a derelict and unusable condition. Residential and university towns have their amenities ruined by new mushroom industries, while towns built for industry stand half-idle. This analysis of social effects is followed by a discussion of the different types of town in relation to industry, an analysis of the main considerations affecting industry and defence, of the need for balanced regional development and a discussion of the aims of national industrial policy.

The final chapter of the report outlines its proposals to meet the main needs not covered by existing machinery—the provision of a centralized research and information service and the effective co-ordination of action. The main proposal is the creation of a permanent Industrial Development Commission to guide the location of industry and advise the Government on the subject. The Commission would be charged with the licensing of new factories or extensions; where a licence was refused, it would be required to indicate broadly the areas and categories of industry in respect of which applications would not in principle be favoured. It would keep under review all factors affecting the efficient operation of industry or affecting economic development of different areas and the location of industry. Like the Commissioners for the Special Areas, it would have resources for giving limited financial help to overcome obstacles to industrial development in specific instances. The Commission would explore the problem of financing new enterprise, would take over the responsibility for supervising existing publicly owned trading estates and for the preservation or restoration of amenities.

The report also suggests that the Commission should take over the machinery for the Special Areas and, particularly, that it should consider the problems of evacuation and re-settlement where necessary. Using Merthyr as an example, it is suggested that transfer as a community of such a town of 63,000 inhabitants at a total cost of £15 millions would represent a total cost to the State in interest and sinking fund of less than the £832,000 actually paid out in 1937–38 to keep much of Merthyr in idleness. It is proposed that the Commission should be responsible to Parliament through a senior Cabinet Minister without departmental duties, and its probable cost need not exceed that of the Special Areas Commissioners, whom the new industrial body would in time supersede.

*Report on the Location of Industry: a Survey of Present Trends in Great Britain affecting Industrial Location and Regional Economic Development, with Proposals for Future Policy. Pp. vii+314. (P E P, 1939.) 10*s.* 6*d.* net.

Control of Metamorphosis in Lepidoptera

J. J. BOUNHIOL has recently published a detailed account of his experiments on this subject, some of which have been published from time to time during the last few years (*Bull. Biologique de France et de Belgique, Suppl.* **24**, 1–199; 1938). Three species of moths were used in this study: the silkworm moth *Bombyx mori*, the wax moth *Galleria mellonella*, and the gipsy moth *Lymantria dispar* in the order of their importance. The paper begins with a description of the life-histories and the methods of rearing. There may be either four or five larval ecdyses in *Bombyx mori*, but careful measurements of the head diameter will show to which instar the larva in question belongs, and whether it is of the four- or five-moulting type. Equally necessary for the correct interpretation of the later experiments was an examination of the effect on the occurrence of metamorphosis of simple starvation begun at various times after the last larval moult. In the case of *Bombyx mori*, the larva must be able to feed for at least seven days for metamorphosis to take place. This is liable to be a complicating factor in experiments in which the aim is to inhibit metamorphosis by an operative procedure. For example, the author finds that section of the ventral nerve cord prevents metamorphosis if the cut is made before the seventh day after the last larval moult; but this, he suggests, is due merely to an interference with the normal nutrition. The same sort of thing has to be taken into account in considering experiments where regions of a larva are separated off by ligatures with the view of finding their importance in metamorphosis.

Perhaps the most interesting part of the work is that dealing with the function of the corpora allata. Dr. Bounhiol describes the delicate surgical method which he has devised for removing these bodies in the larva of *Bombyx mori*. He finds that loss of both corpora allata in the last larval instar has no effect on the occurrence of pupation; but if, on the other hand, the operation be performed in the instar *before* the last, then pupation takes the place of the normally ensuing larval moult and a premature metamorphosis is induced. The same is even true of a still earlier instar and in this way a pupa was obtained which weighed a fortieth of the normal.

The result of corpora allata removal in *Bombyx mori* and the comparable effects following the same operation in the stick insect *Dixippus* (Pflugfelder, *Z. wiss. Zool.*, **149**; 1937) are interesting when compared with the results of Wigglesworth on *Rhodnius* (*Quart. J. Micro. Sci.*, **79**; 1936). Wigglesworth suggested that the corpora allata secreted a hormone inhibiting metamorphosis and another initiating moulting. In *Bombyx* the corpora allata possess the first function but apparently not the second.

Dr. Bounhiol also reports that he repeated and confirmed the experiments of Kopeć, who found that removal of the cerebral ganglia before a certain critical period prevented metamorphosis. Lastly, he discusses the factors controlling metamorphosis in insects and maintains that the view which most experimenters on this line hold, that pupation is initiated by a hormone circulated by the blood, is still unproved. This must be so until someone makes at least a cell-free extract and induces metamorphosis with it.

E. T. BURTT.

Portable Gas Producers

MR. BOSWORTH GOLDMAN and Mr. N. Clarke Jones, in a paper presented to the Institute of Fuel on December 8, 1938 (*J. Inst. Fuel*, **12**, 63, February, 1939), pleaded for recognition of the value of portable gas producers as a means of supplying mobile power as an alternative to petroleum. In the event of world petroleum resources becoming exhausted or of their being restricted in times of national emergency, other fuel would have to be used for vehicular propulsion. Producer gas plants are claimed to be between two and three times as efficient as any oil-from-coal process and yet they can utilize the same cheap and easily available home-produced fuel.

The theory of producer gas practice is based on the conversion of carbon into carbon monoxide, which when mixed with further oxygen is combustible in an engine. To achieve this, five units are necessary: a generator, coolers, scrubbers and/or filter, air inlet device and gas throttle. These units are disposed about the vehicle and connected by pipes. They can be fitted to existing vehicles by modification of the existing engine or alternatively incorporated into a specially designed chassis.

A variety of solid fuels, such as anthracite, charcoal, low-temperature coke and peat may be used in these plants, but their efficiency is dependent on factors of reactivity, size and grading, moisture content, ash and volatile content. Actually there are ample resources of suitable fuel available in Great Britain, but their utilization is hampered by the relative difficulty of obtaining supplies as compared with liquid fuels.

As regards performance, figures obtained for certain types of converted vehicles show that for acceleration and hill climbing this type of fuel is but little inferior to petrol. Moreover, it has been proved that maximum power on gas is obtained at a mixture strength slightly weaker than that theoretically required. In the case of petrol, maximum power is only achieved with a richer mixture than is theoretically needed.

For some time past these and other advantages have been fully appreciated on the Continent, and a considerable number of producer gas vehicles are in use. In Great Britain, however, their utilization has been impeded by the Government's refusal to adjust existing regulations in such a way as to place producer gas propelled vehicles on a similar footing to steam and electricity. Co-operation is required between producer gas plant manufacturers, suppliers of the requisite fuel and members of the automobile industry, if this technique is to be developed and full advantage taken of its potentialities as a substitute for liquid fuel.

Temperature-indicating Paints

THE use of special paints, such as those containing metallic iodides, for application to bearings and other parts of machinery liable to over-heating in order to indicate such temperature increase through change in colour of the paint, has been known for some years (Pinnock, *J. Soc. Chem. Ind.*, **38**, 78; 1919). These earlier preparations were, however, only suitable for comparatively low temperatures, and also the colour change as a rule was not permanent. Paints or thermo-colours adapted for use under much more exacting conditions have been developed in Germany by the I.G. Farbenind. Akt. Ges. in connexion with its fuel research work at Oppau, including aircraft engine design (F. Penzig, *Z. des V.D.I.*, 69–74; 1939).

The method of indicating temperature change and distribution, especially in aircraft engine cylinders, etc., by means of thermo-colours offers many advantages over the usual laborious method of taking several individual temperature measurements in various parts of the cylinder, piston, etc.; and in the case of air-cooled engines it provides invaluable information in the optimum design of air guide plates. It is also of great value in other cases of temperature determination, for example, in hot plates, radiators, drying chambers, etc.

It was desired to discover paints which would not only undergo sharp, distinct, and permanent colour change at fairly definite temperatures, but would also possess good adhesion at these high temperatures, up to 450° C. It is hoped, indeed, to evolve thermo-colours for use up to 650° C. or even higher; but those so far discovered are sufficient for present-day aircraft engine research. In regard to sharpness of change, it is obvious that intermediate tones are to some extent unavoidable since the change is due to thermo-chemical reaction; but with sufficient time the change is definite and complete. On the other hand, allowance must be made for the fact that the longer the time exposure the lower the temperature, within reasonable limits, at which the change occurs. Curves are given in the original showing temperature change at intervals of 30 min. up to 120 min. for the various paints. The time effect is greatest at the higher temperatures: for example, a thermo-colour which by definite colour change indicates a temperature of 360° C. in 30 minutes, falls to 290° at 120 min., whilst the curves at 40–80° C. are nearly horizontal.

No fewer than three hundred different preparations have been investigated at Oppau; but only a very limited number have been found of practical use. These are tabulated by number in the original. The following are some of the colour changes: No. 1, rose to blue, 30°; No. 3. light yellow to violet, 110°; No. 8, white to light brown, 340°; No. 9, violet to white, 440°. No. 20 has two different colour changes at 65° and 145°; whilst Nos. 30 and 31 have three distinct colour changes at temperatures ranging from 65° to 220° (No. 30), and 155–275° (No. 31). The temperatures are indicated with an accuracy within ±5°, which is sufficiently accurate for the purpose in view. Where exact measurement is required at any particular point this can be done in the usual way with thermo-elements.

The binding agent or medium used presented some difficulty; it was eventually discovered that a synthetic resin soluble in alcohol is the most satisfactory. It is added in finely powdered form to the pigment, and a paint of any desired viscosity may be prepared by stirring this mixture with the correct amount of alcohol. These paints dry very quickly, the resin does not undergo any colour change which would affect the desired result, and the paint coating has practically no influence on heat transference from the cylinder or other part under test.

Testing High-Voltage Cables

THE use of high-voltage cables for the underground transmission of electric power is becoming more and more important from the point of view of economy, and also because as the network extends the damage caused by the breakdown of a cable, generally due to over-voltage, may be very serious. For the last ten years constant research has been proceeding, dealing with oils, papers and the general physics of cables. In the development of a cable suitable for extra-high voltage transmission there have been four main methods of attack. The first is to use oil-filled cable, the second external gas-pressure cable, the third internal gas-pressure cable (gas-filled cable), and the fourth the cables most commonly used with solid insulation known as 'solid cables'.

In a paper read to the Institution of Electrical Engineers on January 18, by T. R. Scott and R. C. Mildner, the results are described of researches extending over several years on a 3-core 30 kv. solid cable which has since, without any fundamental change, been manufactured in considerable quantity and has given extremely satisfactory service. Single-core cable manufactured on identical lines was somewhat inferior in performance. At 60 kv. this difference became very noticeable, although on the basis of standard acceptance tests there was little or nothing to choose between multi-conductor and single-conductor cables. It became evident, therefore, that some form of final check approximating to 'trial on service' was necessary to ensure that unsatisfactory types of cable were not issued for commercial service. In view of the destructive nature of the test that was visualized, it was considered impracticable to instal the cable in the network of an operating company. It was considered feasible to design a testing plant to reproduce all the conditions under which cables operated, and yet give the facilities which such a research requires. It was realized that such a method

would be slow to produce results and expensive to carry out; but its value has been amply proved by the practical results achieved.

Solid-core 60 kv. cable was originally selected as the basic type. It was considered that this type of cable would always be able to compete on an economic basis with the other forms of cable that have been proposed, provided that it could be proved that it was capable of operating at a conductor temperature not less than 65° C. for a life not appreciably less than that of solid cables operating at lower voltages. Work on solid-type 60 kv. cables also provided an excellent basis not only for effecting improvements in the performance of similar cables working at 30 kv. and lower voltages, but also for extending the investigation to 132 kv. All experimental cables were 'processed' in the factory under closely observed, but essentially practical, conditions, and their characteristics have been watched carefully throughout their useful life. The paper gives a preliminary survey of the work carried out to date.

It is hoped that the results obtained will assist in allaying certain fears which obviously influence cable users. The authors state that as the result of the experience gained in their tests the successful operation of solid-type cable at 60 kv. has been firmly established. The employment of this form of cable in preference to the other types which have been proposed, should rest on a purely economic basis in which the cost of the installed line and its maintenance is added to the charges to be attributed to the electrical losses involved in operation. In this latter respect the stability of the dielectric need be in no way inferior to that of other types. It is pointed out that the deterioration due to the electric discharges in vacuum spaces (gas pockets) can be reduced to negligible proportions at the proposed working stresses by due attention to the quality of manufacture. In this matter the authors' experience suggests that 'uniformity of impregnation' is the main object to be aimed at rather than getting the purest material. As the 'geometric factor' of the cables tested varies widely, it is concluded that the maximum electric stress in the cable is the crucial factor in its behaviour in operation.

University Events

BIRMINGHAM.—The following honorary degrees are to be conferred at the degree congregation on July 1: LL.D. on Mr. A. C. Beatty, Lord Porter, and Sir Charles Grant Robertson; D.Sc. on Dr. E. B. Bailey, and Sir William Bragg; D.Litt. on Prof. Arnold J. Toynbee.

CAMBRIDGE.—The tenth course of Scott Lectures are being given in the Cavendish Laboratory by Prof. P. M. S. Blackett, at 4.30 p.m. on May 4, 5 and 8. The subject of the lectures is "Cosmic Rays—New Results and Further Problems".

W. S. Tai, research student of Gonville and Caius College, has been elected to the Sheepshanks exhibition.

LONDON.—The Farnham House Laboratory of the Imperial Institute of Entomology, at Farnham Royal, Bucks, has been approved as an "Institution having Recognised Teachers" for the instruction of students pursuing courses of advanced study or research.

Science News a Century Ago

Ptolemy's Catalogue of Stars

AT a meeting of the Astronomical Society held on May 10, 1839, Francis Baily, in a paper bearing the above title, said: "The catalogue of stars, which goes under Ptolemy's name, will always be interesting to the astronomer, as containing the first record of the state of the heavens. The point to which, in the present view of the case, I am most desirous of directing attention is, how far the existing edition of this work may be considered as faithful transcripts of the catalogue as it issued from Ptolemy's hands. This important question can only be decided by a careful examination of various manuscripts, and by comparing the discordant readings with the actual positions of the stars, as determined by modern observations." Having referred to the five sources of information, he went on: "Having carefully compared the position of every star, as given in each of the several copies alluded to, I have found that out of 1,028 stars, of which the catalogue consists, there are above 780 (or more than three-fourths) of them that are discordant, either in longitude or latitude, and this not merely in 10, 20, or 30 minutes, which is no uncommon difference, but sometimes to an amount involving whole degrees."

The Atlantic Voyage of the *Ironsides*

IN October 1838, Airy, at the request of the owners of the iron sailing ship *Ironsides*, had made improvements in the method of correcting her compasses. Shortly afterwards, the ship sailed for South America. After her return, the *Mechanics' Magazine* on May 11, 1839, said: "This, the first sailing vessel constructed of iron which has ever been dispatched to encounter the risk of a transatlantic voyage, and which left Liverpool some five months since, for the Brazils, entered the Mersey on the 1st of May. The homeward passage from Aricati was accomplished in forty days, which is considered to be no despicable achievement, as during the whole trip light winds prevailed. The return of the *Ironsides*, has completely established the practicability of navigating the ocean safely and surely in ships constructed of iron. The compass, whose action it was predicted would invariably be deranged, worked correctly; and the superiority of the material of which she is built is proved by the fact, that from the day on which she sailed for Pernambuco, during the time she remained at the Brazils, and in the course of her voyage home, on no one occasion was it necessary to use the pumps; in fact her hull is absolutely and literally water tight."

The Asiatic Society

AMONG the reports read at the sixteenth anniversary meeting of the Asiatic Society on May 11, 1839, was one by the Right Hon. Holt Mackenzie referring to the work of the Committee of Commerce and Agriculture. It commenced by acknowledging the valuable services of Dr. Royle (secretary) and Mr. Solly (chemical analyst). Attention, it said, had been given to the introduction into India of improvements in cotton cultivation; the value and quality of various oil seeds grown in India and the vegetable tallow of Canara; and information had been collected regarding caoutchouc, kino, hemp, tea, iron, cochineal, timber, wool, silk and other things.

Societies and Academies

Paris

Academy of Sciences (*C.R.*, **208**, 953–1060, March 27, 1939).

M. ROY : Diagram of the flow of a gas through a rotary tuyere.

J. KUNTZMANN : Classes in a multigroup.

T. PÉVOVITCH : Value at infinity of the integrals of certain differential equations.

W. BARRETT : Certain discontinuous groups of displacements.

R. MOINEAU : The autopropulsive and hyper-sustaining flapping wing.

D. BELORIZKY : Collisions in the problem of three bodies and in space.

G. PETIAU : Electromagnetic magnitudes of the theory of the photon.

J. MARIANI : Quantum of length and the spin of elementary particles.

J. GUASTALLA : Surface manometer with pendulum suspension [for the measurement of the pressure of surface films].

M. JOLY : Existence of two forms of superficial protein films. Very stable films of low viscosity, and very viscous films which 'age' with time are distinguished.

P. VERNOTTE : Convection of heat, from a plane in which there is any distribution whatever of temperature, by an indefinite fluid of two dimensions in which there is any distribution of velocities : application to the law of natural convection.

G. DUYCKAERTS : Specific heats of iron between 1·5° and 20° K.

R. GUILLIEN : Dielectric constant of ammonium sulphate in the neighbourhood of the λ-point. Dielectric constant and electric absorption have a maximum at the λ-point.

F. CARBENAY : High-frequency radio communication along power lines.

R. AUDUBERT and R. RALEA : Photogenic effect and electronic activation of the radical $N \equiv N$.

L. ABONNENC : Diamagnetism of the rare gases of the atmosphere—argon, krypton, xenon.

A. DUFOUR and F. PRUNIER : An effect observed with a Sagnac disk in rotation when a part of the optical circuit is not in rotation.

A. PIEKARA : Influence of molecular interaction on the magnetic birefringence of polar liquids.

J. VERHAEGHE and M. VAN EYCK : Circular magnetic dichroism of cobalt sulphocyanides.

A. COTTON : Note on the preceding paper.

M. DODÉ, H. VON HALBAN, JUN., F. JOLIOT and L. KOWARSKI : Energy of neutrons liberated in the nuclear partition of uranium. The experiment described, while showing the neutrons produced are distinct from the incident neutrons, does not demonstrate the possibility of chain reactions.

M. BRUTZCUS : Thermochemistry of combinations of nitrogen.

MLLE. M.-L. DELWAULLE : Study of the Raman effect of equilibrium reactions in the formation of mercuric chlorobromide and bromocyanide.

F. FRANÇOIS : Study of the system mercuric cyanide, mercuric chloride and methyl alcohol. Formation of an addition compound of mercuric chloride and methyl alcohol and evidence by the Raman effect of a chlorocyanide.

E. TOPORESCU : New method of studying the polarization of galvanic piles.

H. VOLKRINGER, MME. M. FREYMANN and R. FREYMANN : Influence of temperature on the Raman spectrum of ammonium nitrate and sulphate.

(*To be continued.*)

Amsterdam

Royal Netherlands Academy (*Proc.*, **42**, No. 2, 1939).

F. K. TH. VAN ITERSON : The pressure of the roof on the coal near the coal face. A mathematical consideration of the problem by the methods of the theory of elasticity.

L. S. ORNSTEIN and W. DE BRAAF : Remarks on the paper of V. Zwetkoff, "Ueber die Lichtzerstreuung in anisotropen Flüssigkeiten".

R. FÜRTH, L. S. ORNSTEIN and J. M. W. MILATZ : On the theory of liquids. A provisional mathematical treatment of the theory of liquids regarded as quasi-crystalline structures containing many 'holes' or faults.

A. J. KLUYVER and E. L. MOLT : On the production of acetylmethylcarbinol by *Bacterium coli*. This bacterium has been shown capable of producing small amounts of acetylmethylcarbinol under the conditions of the Voges-Proskauer test, so that the theoretical basis of the latter test for distinguishing *B. coli* from *B. aerogenes* loses much of its significance.

E. DUBOIS : On the insignificance of cranial vault-height in phylogenetic brain growth.

B. G. ESCHER : Moon and earth. Geological considerations on the development of continents and oceans, the limitation of granitic magma to the continents, the composition and morphology of the moon.

H. FREUDENTHAL : New continuation and mapping theorems.

C. S. MEYER : Integral representations of Whittaker functions.

J. TEGHEM : On a type of Diophantine inequalities.

P. G. MOLENAAR : A complete system of differential co-variants of the first order of the binary cubic differential form.

H. D. KLOOSTERMAN : On the singular series in Waring's problem and in the problem of the representation of integers as a sum of powers of primes.

I. LIPSCHITZ : On dissymmetrical synthesis in the case of complex metallic salts (3).

W. P. POSTMA : Some remarks on the influence of nitrate reduction on the respiration of roots.

F. C. J. ZEIJLEMAKER : Carboxylase and co-carboxylase in the germination of *Avena*. The total amount of co-carboxylase remains constant during germination.

J. C. MOOI : On the enzymes taking part in the conversion of alanin and of asparaginic acid by *Aspergillus niger*.

C. J. JASKI : An œstrus cycle in *Lebistes reticulatus* (Petus).

W. RIESE : The hemispherical wall of the new-born bear and the evolution of the nerve cell.

G. P. FRETS : (1) The growth curves of the dimensions and of the weight of the seeds of *Phaseolus vulgaris*. (2) A second group of observations regarding dimension and form with the growth of the seeds of *Phaseolus vulgaris*.

Moscow

Academy of Sciences (*C.R.*, **21**, Nos. 1–2, 1938).

S. FINIKOFF: Deformation of a surface with the extension of lines of a family.

A. G. PINSKER: Extension of semi-ordered spaces.

M. S. EIGENSON: Surface brightness of the night sky and the infinity of the astronomical universe.

M. N. PODASCHEWSKY and A. M. POLONSKY: Luminescence of alkali-halogenid crystals.

J. S. SHUR: Influence of heat treatment in a magnetic field upon the distribution of the spontaneous regions of a ferromagnetic monocrystal.

D. BLOKHINTZEV and B. DAVYDOV: Some contributions to the theory of solid rectifiers.

K. S. WULFSON and M. I. LOMBERT: Dispersion of light in crystals of quartz.

A. I. ALICHANIAN and S. J. NIKITIN: β-ray spectrum of RaC and energy-levels of excitation of RaC^1 nucleus.

D. IWANENKO: Simple applications of the Proca potential.

A. SOKOLOV: Nature of heavy electron.

D. I. MIRLIS and A. I. GLUCHOVA: Kinetics of wetting and the linear-selective corrosion of metals in polyphase systems.

W. STERN, B. KRAVETZ and A. SOKOLIK: The action of carbon dioxide on self-combustion of the mixture hexane-air.

M. G. KRITZMANN: Isolation of the enzyme transferring the amino-group of glutamic acid.

A. V. VLADIMIROV and G. V. LIASKOVSKAJA: Age and daily variations of citric acid content in leaves of *Nicotiana rustica*.

G. D. AFANASSIEV: Indications of rare metal mineralization in the south-east of the Altai mountains.

A. I. ZUITIN and M. T. PAVLOVETZ: Age differences in spontaneous mutation in males of *Drosophila melanogaster* of different origin.

A. I. ZUITIN: (1) Influence of a change of thermal regime upon the frequency of lethal mutations in *Drosophila melanogaster*. (2) Combined effect of a change of thermal regime and subsequent temperature contrast upon the frequency of lethal mutations in *Drosophila melanogaster*.

G. D. KARPECHENKO: New tetraploid barleys—the hulled and the naved.

V. I. PATRUSHEV: Blood-value of cross-breeds between the wild *Ovis Polii Karelini* Sew. and the domestic sheep.

A. SOKOLOVSKAJA and O. S. STRELKOVA: Polyploidy in the high mountain regions of the Pamir and the Altai.

L. M. DOROKHOV: (1) Dynamics of carbohydrate accumulation in plant leaves as influenced by different content of carbon dioxide in air. (2) Effect of carbon dioxide upon transpiration and stomatal apparatus in plants.

V. G. ALEXANDROV and O. G. ALEXANDROVA: Structure of the furrow in wheat kernel.

L. M. DOROKHOV: Alteration of physiological processes in tomato under the influence of *Cladosporium fulvum* Cke.

V. I. PATRUSHEV: Blood value of Yaroslavl cattle in correlation with body weight and yield of milk.

K. K. FLEROV: Remains of Ungulata from Betpak-dala.

Forthcoming Events

[*Meeting marked with an asterisk is open to the public.*]

Monday, May 8

ROYAL SOCIETY OF ARTS, at 8.—Prof. E. C. Dodds: "Modern Chemistry, Modern Medicine and Modern Food" (Cantor Lectures. Succeeding lectures on May 15 and 22).

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Dr. D. Thomson: "Journeys in Arnhem Land".

Tuesday, May 9

ST. MARY'S HOSPITAL, LONDON, W.2, at 5.—Dr. V. D. Allison: "The Mode of Spread of Acute Streptococcal Infections".

UNIVERSITY COLLEGE, LONDON, at 5.30.—Sir Philip Hartog: "The Newer Views of the Work of Priestley and Lavoisier" (succeeding lecture on May 16).*

ILLUMINATING ENGINEERING SOCIETY (at the Institution of Mechanical Engineers), at 7.—Annual General Meeting.

P. Good: Presidential Address.

Wednesday, May 10

INSTITUTE OF METALS (at the Institution of Mechanical Engineers), at 8.—Dr. Olaf Bloch: "The Photographic Emulsion and its Contribution to Science and Industry" (Annual May Lecture).

Thursday, May 11

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Annual General Meeting.

Captain B. S. Cohen: "The Long-Distance Telephone Call—A Triumph of Engineering and Co-operation" (Faraday Lecture).

Friday, May 12

ROYAL ASTRONOMICAL SOCIETY (in the lecture room of the Royal Society), at 5.—M. Bernard Lyot: "Study of the Solar Corona and Prominences without Eclipses" (George Darwin Lecture).

ROYAL INSTITUTION, at 9.—Prof. J. Garstang: "Discoveries in Cilicia".

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

LECTURER IN METALLURGY AND CHEMISTRY in the Oxford Schools of Technology, Art and Commerce—The Chief Education Officer, City Education Office, 77, George Street, Oxford (May 8).

JUNIOR LECTURER IN ELECTRICAL ENGINEERING and JUNIOR LECTURER IN METALLURGY in the University of the Witwatersrand—The High Commissioner for South Africa, South Africa House, Trafalgar Square, W.C.2 (May 13).

LECTURER IN BIOLOGY in the Kingston-upon-Thames Technical College—The Principal (May 15).

WOMAN EXAMINER in the Metallurgical Section of the A.R.D. Test House, Cardington, Beds.—The Under-Secretary of State, Air Ministry, Berkeley Square, London, W.1 (Ref. *ICS./REC.* 38. May 16).

LECTURER IN ELECTRICAL ENGINEERING in the Croydon Polytechnic—The Education Officer, Education Office, Katharine Street, Croydon (May 18).

PROFESSOR OF ELECTRICAL ENGINEERING in the University of Birmingham—The Secretary (May 22).

JUNIOR SCIENTIFIC OFFICER in the Forest Products Research Laboratory—The Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, S.W.1 (May 23).

JUNIOR SCIENTIFIC OFFICER in the Road Research Laboratory—The Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, S.W.1 (May 23).

ASSISTANT LECTURER IN MATHEMATICS in the University of Manchester—The Registrar (May 25).

ASSISTANT LECTURER IN ELECTRICAL ENGINEERING in the Manchester Municipal College of Technology—The Principal (May 31).

ASSISTANT IN MORBID ANATOMY and ASSISTANT IN CLINICAL PATHOLOGY in the British Post-graduate Medical School, Ducane Road, W.12—The Dean (June 5).

ASSISTANT CHEMIST (male) in the Engineering Department of the General Post Office—The Engineer-in-Chief (Staff Branch), General Post Office, Alder House, Aldersgate Street, London, E.C.1 (June 9).

Reports and other Publications

(not included in the monthly Books Supplement)

Great Britain and Ireland

Development Commission. Twenty-eighth Report of the Development Commissioners, being for the Year ended the 31st March 1938. Pp. 184. (London: H.M. Stationery Office.) 3s. net. [313

National Physical Laboratory. Report for the Year 1938. Pp. iv+147. (London: H.M. Stationery Office.) 2s. 6d. net. [313

Quarterly Journal of the Royal Meteorological Society. Vol. 65, No. 279: The Phenological Report, 1938. Pp. 75–122. (London: Royal Meteorological Society.) 3s. [313

Researches published from the Wards and Laboratories of the London Hospital during 1938. Pp. iv+37 Papers. (London: H. K. Lewis and Co., Ltd.) 7s. 6d. net. [34

University of Leeds. Thirty-fourth Report, 1937–38. Pp. 184. Publications and Abstracts of Theses by Members of the University during Session 1937–38. Pp. 31. (Leeds: The University.) [44

Report of the Marlborough College Natural History Society for the Year 1938. (No. 87.) Pp. 160+6 plates. (Marlborough: Marlborough College.) 3s.; to non-Members, 5s. [44

Imperial Forestry Institute. Institute Paper No. 16: A Forestry Tour in 1937. By Dr. L. Chalk. Pp. 71. (Oxford: Imperial Forestry Institute.) 2s. 6d. [44

Metallurgy as a Career. Pp. 8+2 plates. (London: Sir John Cass Technical Institute.) [44

Department of Scientific and Industrial Research. Index to the Literature of Food Investigation. Vol. 7, No. 2, September 1935. Compiled by Agnes Elisabeth Glennie, assisted by Gwen Davies. Pp. v+373–604. (London: H.M. Stationery Office.) 5s. net. [54

Annual Report of the Council of the Yorkshire Philosophical Society for the Year 1938, presented to the Annual Meeting, February 13th, 1939. Pp. 51+17+2 plates. (York: Yorkshire Museum.) [64

Report of the Rugby School Natural History Society for the Year 1938. (72nd issue.) Pp. 60. (Rugby: George Over, Ltd.) [64

Scientific Proceedings of the Royal Dublin Society. Vol. 22 (N.S.), No. 8: Atmospheric Pollution in Dublin during the Year 1938. By A. G. G. Leonard and Bridget P. McVerry. Pp. 83–94. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) 1s. [64

Air Ministry: Aeronautical Research Committee. Reports and Memoranda, No. 1834 (3422): An Analysis of the Stresses in a Flat Plate with a Reinforced Circular Hole under Edge Forces. By C. Gurney. Pp. 25. (London: H.M. Stationery Office.) 3s. 6d. net. [114

Other Countries

Proceedings of the American Academy of Arts and Sciences Vol. 73, No. 3: The Lower Permian Insects of Kansas, Part 8. By Frank M. Carpenter. Pp. 29–70+2 plates. 1.25 dollars. Vol. 73, No. 4: Studies on the Fauna of some Thermal Springs in the Dutch East Indies. By Charles T. Brues. 80 cents. (Boston, Mass.: American Academy of Arts and Sciences.) [313

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 90. Additions to our Knowledge of African Leeches (Hirudinea). By J. Percy Moore. Pp. 297–360. Studies in African Acrydiinae (Orthoptera, Acrididae), Part 2: New Genera and Species, and Critical Notes on Previously-known Forms. By James A. G. Rehn. Pp. 361–388. The Orthoptera of the Philippine Islands, Part 1: Phasmatidae; Orbriminae. By James A. G. Rehn and John W. H. Rehn. Pp. 389–488. (Philadelphia: Academy of Natural Sciences.) [313

Bulletin of the Seismological Society of America. Vol. 29, No. 1: Descriptive Catalog of Earthquakes of the Pacific Coast of the United States, 1769 to 1928. By Sidney D. Townley and Maxwell W. Allen. Pp. 298. (Berkeley, Calif.: University of California Press.) 2 dollars. [313

U.S. Department of the Interior: Office of Education. Know your School Leaflet No. 47: Know your Board of Education. By W. S. Deffenbaugh. Pp. iii+9. 5 cents. Know your School Leaflet No. 48: Know your Superintendent. By W. S. Deffenbaugh. Pp. iii+9. 5 cents. Know your School Leaflet No. 49: Know your School Principal. By W. S. Deffenbaugh. Pp. iii+9. 5 cents. Know your School Leaflet No. 50: Know your Teacher. By W. S. Deffenbaugh. Pp. iii+12. 5 cents. (Washington, D.C.: Government Printing Office.) [313

U.S. Department of Agriculture. Technical Bulletin No. 659: The Sand Wireworm and its Control in the South Carolina Coastal Plain. By J. N. Tenhet and E. W. Howe. Pp. 39. (Washington, D.C.: Government Printing Office.) 10 cents. [313

Pennsylvania State College School of Agriculture and Experiment Station. Bulletin 371: Phosphorus Deficiency among Cattle in Pennsylvania. By E. B. Forbes and S. R. Johnson. Pp. 25. (State College, Pa.: School of Agriculture and Experiment Station.) [313

Journal of the Indian Institute of Science. Vol. 22 A, Part 4: Supersonic Velocity in Gases and Vapours. Part 7: Specific Heats of the Vapours of Dichloromethane, Chloroform, Carbon Tetrachloride and Ethylene Dichloride. By S. K. Kulkarni Jatkar. Pp. 59–78. (Bangalore: Indian Institute of Science.) 1.8 rupees. [34

Published Papers and Addresses of John Campbell Merriam. (Publication No. 500.) Vol. 1. Pp. viii+666. Vol. 2. Pp. vi+667–1288. Vol. 3. Pp. viii+1289–1944. Vol. 4. Pp. viii+1945–2672. (Washington, D.C.: Carnegie Institution.) [34

Co-operation in Research. By Staff Members and Research Associates of the Carnegie Institution of Washington. (Publication No. 501.) Pp. ix+782. (Washington, D.C.: Carnegie Institution.) [34

Proceedings of the United States National Museum. Vol. 86, No. 3051: Annotated List of Tennessee Mammals. By Remington Kellogg. Pp. 245–304. (Washington, D.C.: Government Printing Office.) [

Advisory Committee on Education. Staff Study No. 2: Organization and Administration of Public Education. By Walter D. Cocking and Charles H. Gilmore. Pp. ix+182. (Washington, D.C.: Government Printing Office.) 20 cents. [

South Australia: Department of Mines. Mining Review for the Half-Year ended 30th June 1938. (No. 68.) Pp. 101+10 plates. Annual Report of the Director of Mines and Government Geologist for 1937. Pp. 8. (Adelaide: Government Printer.) [

Meddelande från Lunds Astronomiska Observatorium. Ser. 2, No. 102 (Historical Notes and Papers, Nr. 14): The Luni-Solar Calendar. By Lewis A. R. Wallace. Pp. 12. (Lund: Astronomiska Observatorium.) [

Sveriges Geologiska Undersökning. Ser. C, No. 418: Neue Untersuchungen innerhalb des Grängesbergfeldes. Von Nils H. Magnusson. Pp. 45+1 plate. 2.00 kr. Ser. C, No. 420: Sjösediment från Bergslagen (Kolbäcksans vattenområde). Av G. Lundquist. Pp. 186+8 plates. 2.50 kr. Ser. C, No. 422: Nedre Klarälvsdalens postglaciala utvecklingshistoria. Av R. Sandegren. Pp. 38+1 plate. 1.00 kr. (Stockholm: P. A. Norstedt and Söner.) [

U.S. Department of the Interior: Office of Education. Leaflet No. 54: Federal Funds for Education, 1937–38. Pp. iii+27. (Washington, D.C.: Government Printing Office.) 10 cents. [

Annales scientifiques de l'Université de Jassy. Première partie (Mathématiques, physique, chimie), Tome 24, Année 1938, Fascicule 2. Pp. 263–514+ii. Second partie (Sciences naturelles), Tome 24, Année 1938, Fascicule 2. Pp. 287–468+ii. (Jassy: l'Université de Jassy). [114

Report of the Aeronautical Research Institute, Tōkyō Imperial University. No. 172: Calculation of Induced Velocity by Helical Vortices and its Application to Propeller Theory. By Sandi Kawada. Pp. 58. 80 sen. No. 173: On the Effect of the Density of the Air upon the Pitot-static Tube Coefficient. By T. Sasaki and K. Hattori. Pp. 59–90. 55 sen. (Tōkyō: Kōgyō Tosho Kabushiki Kaisha.) [114

Journal of the Faculty of Agriculture, Hokkaido Imperial University. Vol. 44, Part 2: Studies on the Infection of *Piricularia Oryzae* Br. et Cav. on Maltreated Rice Plants. By Y. Tochinai and S. Komiya. Pp. 33–76. (Tokyo: Maruzen Co., Ltd.) [114

Sveriges Geologiska Undersökning. Ser. C, No. 415: Deep Boring through the Cambro-Silurian at File Haidar, Gotland. By Per Thomlund and A. H. Westergård. Pp. 56+4 plates. 2.00 kr. Ser. C, No. 416: The Injection Metamorphism of the Muruhatten Region and Problems suggested Thereby. By Torsten Du Rietz. Pp. 86. 2.00 kr. Ser. C, No. 417: Hauptzüge der Tektonik und Stratigraphie der mittleren Kaledoniden in Schweden. Von B. Asklund. Pp. 99. 2.00 kr. Ser. C, No. 421: On Swedish Cambrian Asaphidæ. By A. H. Westergård. Pp. 16+3 plates. 1.00 kr. (Stockholm: P. A. Norstedt and Söner.) [114

Festschrift zum 60 Geburtstage von Prof. Dr. Embrik Strand. Vol. 5. Pp. 750+11 plates. (Riga: Sistematiskās Zoologijas Institūts; London: H. E. Knowles.) 24s. 6d. [114

Parliament of the Commonwealth of Australia. Twelfth Annual Report of the Council for Scientific and Industrial Research for Year 1937–38. Pp. 96. (Canberra: Government Printer.) 4s. [114

Sudan Government: Department of Agriculture and Forests. Annual Report, Part 2: Being the Report of the Agricultural Research Service for the Year ended 31st December 1937, relating to Experimental Results obtained in the Crop Season 1936–37. Pp. 140. (Wad Medani: Agricultural Research Service.) [114

Third Annual Report of the Indian Institute for Medical Research, 1937–38. Pp. viii+62. (Calcutta: Indian Institute for Medical Research.) [114

Smithsonian Miscellaneous Collections. Vol. 98, No. 2: The Sunspot Period. By H. Helm Clayton. (Publication 3526.) Pp. ii+18+1 plate. (Washington, D.C.: Smithsonian Institution.) [114

Agriculture and Animal Husbandry in India, 1936–37. Pp viii+503. (Delhi: Manager of Publications.) 7 rupees; 11s. [114

Catalogues, etc.

Dulau's Botanical Catalogue. (No. 277.) Pp. 40. (London: Dulau and Co., Ltd.)

The Microid Gas Generator. (GT 1235 A.) Pp. 2. British Standard Scientific Glassware. (GT 1242.) Pp. 2. THQ (Tetrahydroxyquinone). (GT 1246.) Pp. 4. (London: Griffin and Tatlock, Ltd.)

Wild Barfield Heat-Treatment Journal. Vol. 3, No. 20, March. Pp. 39-51+v. (London: Wild-Barfield Electric Furnaces, Ltd.)

Catalogue of Modern Chemical Apparatus: Selected for Analytical, Educational and Research Laboratories in the practice of Inorganic, Organic, Physical and Microchemistry and Bacteriology and their Industrial Applications. (Catalogue No. 15 B.) Pp. 1144. (London: Griffin and Tatlock, Ltd.)

Engineering and Industrial Instruments. (General Bulletin N.10.) Pp. 60. (London: Negretti and Zambra.)

Catalogue of Physical Laboratory Apparatus and Equipment. Twenty-fifth edition. Pp. xvi+824 (London and Birmingham: W. and J. George, Ltd., proprietors of F. E. Becker and Co.)

Wratten Safelights for the X-Ray Darkroom. Pp. 4. (London: Kodak, Ltd.)

Catalogue of Publications. Pp. 130. (Den Haag: Dr. W. Junk.)

Mullard Cathode Ray Tube Unit, Type B. 100. Pp. 2. (London: Mullard Wireless Service Co., Ltd.)

Cambridge Automatic Regulators, Electrically Operated. (Folder No. 67.) Pp. 6. (London: Cambridge Instrument Co., Ltd.)